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CONTENTS.

	PAGE
Editorial	1
Fourth Annual Convention of the Pacific Coast Electric Transmission Association	4
Electric Lighting of Railway Trains, by Geo. D. Shepardson	5
Opportunities for Establishment of Electrical Plants in the Philippines, by G. D. Rice	8
Summer Convention of the Northwestern Electrical Association	10
American Association for the Advancement of Science, by W. H. Hale, Ph.D.	12
Electrical Calcutta, by R. W. Ashcroft	14
The International Tramways and Light Railways' Exhibition	14
The Paris Exposition Third-Rail Road	15
U. S. Electrical Section, Electricity Building, Paris Exposition	17
Nernst Lamp Patents	22
Current News and Notes	24
LETTER TO THE EDITORS:	
The Incandescent Lamp and Photography, by Eugene J. Moynihan	25
Digest of Current Electrical Literature, by Carl Hering	25
Cutter Circuit Breakers in England	30
Exhibits Northwestern Convention	30
New Form of Telephone Transmitter	31
Greenfield Vertical Engine	31
The Westinghouse Electric Factory at Havre, France	32
Twenty Years of the Edison Lamp	34
G. I. Automatic Circuit Breakers	35
Elwell-Parker Automobile Motor	36
Conover Combined Air and Circulating Pump	36
Roebling Wire Exhibit, Paris Exposition	37
A Gaulard & Gibbs Alternating-Current Patent	37
Improved Tapping Attachment	37
Organization of the American Bridge Co	38
DEPARTMENTS:	
Financial Intelligence	39
Commercial Intelligence	39
General News	41
Trade Notes	42
Record of Electrical Patents	43, 44

FOREIGN TRADE.

There is every indication that American export trade this year will be the largest on record. At the rate shown by the 11 months of the fiscal year, the total will run up to not less than $1,400,000,000, or about $175,000,000 more than last year. These are significant figures, far more so than can be understood for some time to come, for the simple reason that they are but a beginning. To make this fact clear, it may be pointed out that our export trade has more than doubled in 25 years, and yet only within the past decade has any effort been made to secure foreign markets. In the five years ending 1874, our import trade was 2792 million dollars, and our export trade was 2388 million dollars. In the five years ending 1899, our import trade was 3589 million dollars and our export trade was 5199 million dollars, while much of the importation was raw material for manufacture.

This year, exports will exceed imports by over $500,000,000, and new lines have opened up which will find rapid expansion in 1901. As for electricity, there is no branch of American industry which can equal it in prospects of profitable expansion. It does not need a visit to the Paris Exposition to ascertain this simple fact, great as is the impression to be derived there and from the conditions in Paris itself. The lesson can be learned from our weekly data of electrical exports, and from such articles as appear in this issue on opportunities in the Philippines and on the conditions in Calcutta. Even China, which is to-day making its last protest against progress, is doing so with the weapons and appliances of the Western World, and is about to open up as a market. In Africa the approaching *Pax Britannicum* means much more to Americans than it does to the English in the opening up of a large market, and it is difficult, in fact, to turn to any part of the world where American manufactures, like American foods, oil and coal, cannot make their way. This trade is not to be had by sitting still, but by going after it with every agency that can help secure the prize. Moreover, with the larger world area for our goods, prices will be cheapened at home because of the bigger scale of production, and this in turn again will ease the strain of competition for our manufacturers. The welcome extended is far stronger than the jealousy excited, for after all, we are but adding to the world's resources of comfort and convenience, and doing it cheaper than it was ever done before.

CABLE RATES.

There has been quite an agitation recently for lower cable rates, as noted in these columns, and it has been renewed with some vigor, due probably to the extension of our foreign trade and the increase of intimate relations not only with Europe, but with the Far East. While such lower rates would be desirable, it is certain that the schemes for reducing them, say, to one-seventh or one-eighth of their present scale are very unlikely to be realized. It seems natural to think that 25 cents per word is a lot of money to pay for a message between here and Europe, but even at that rate the cable companies do not pay very large dividends. And the people who complain forget that those who do the bulk of the cabling use codes freely and pack a wonderful amount of news or advices into one short word. In fact, if it were not for the codes, the cable companies probably would be unable to handle all the business in

the rush hours. Besides that, the cables do a tremendous amount of work for the newspapers at cut rates in the slack hours—work that is of more or less direct interest and value to every citizen of the United States.

Nothing is said in the low rate articles, usually, about the expenses of maintenance, although the companies not only have their renewal funds to keep up, but have to maintain fleets of repair ships. The reserve fund looks like writing off the capital cost, but when losses come, such as those which fell last week on the North German Lloyd by its disastrous fire, such reserves show up in their true light. Besides, ocean cable repairs in winter are often very slow and very expensive, and must be paid for out of earnings. All things considered, there are marks with more shine to them than the cable companies, when it comes to rate reduction, and at a period when every item of expense is higher than it has been for years past, it does seem as though the agitation for lower cable rates was a bit untimely.

THE SHOEMAKER'S WIFE.

Last week witnessed the opening of the new London underground, running from the centre of the city out into the far western sections. The Prince of Wales was graciously pleased to express his high approval of the excellent American material and apparatus which he saw all around him in making a formal trial trip over the road; but what is far more to the purpose, the people are already beginning to flock out to the suburbs thus brought nearer. To such an extent has the migration gone, houses have advanced considerably in value because at present there are not enough of them at such points as Shepherd's Bush. This news of the London opening comes just a few weeks after that of the trial of the first section of the new Paris Metropolitan underground, where once again American electrical apparatus has been used.

There is an old saying that the shoemaker's wife goes ill-shod, and it has a pertinency to the situation which discloses the two leading capitals of the old world equipped with American underground electric railways, while not a city in this country has anything of the kind, unless we count in the Boston subway, which is simply a sunken track for trolley cars. However, in a few years we shall be able to try underground roads here without going to Europe for the experience, while it is not improbable that many useful points in practice will have been developed in Europe that will be worthy of study or imitation.

THE NERNST LAMP.

Elsewhere in this issue appears an account of two score and more of patents issued last week on details of the Nernst lamp system, which are particularly interesting in a general way as giving indications of the difficulties that have been, or are still to be, overcome in its commercial development. Naturally, one of the most important of these is the means to bring the glower to a conductive temperature, and several devices for this purpose are described. These may be classified as stationary and movable heaters, the latter being removed from proximity to the glower by electromagnetic means when they have accomplished their object. As the heaters exercise but a momentary function as lights are turned on, the provision of means for their withdrawal from circuit also naturally calls for inventive skill, and a number of circuit arrangements and switch devices for this purpose are described. Since the glowers are composed of earth metals which have more of the characteristics of the first than of the second part of the materials entering into the name, the means for securing good and lasting contact with leading-in connections form a problem to which two solutions are offered by that number of patents. Other patents relate to purely constructional features analogous to those covered by the early incandescent lamp patents on bases, sockets, etc. This budget of patents gives direct assurance that, notwithstanding the silence during the past several years as to the status of the Nernst lamp as an electric lighting factor, its development to a commercial stage is being energetically and systematically carried on.

THE GAULARD AND GIBBS ALTERNATING CURRENT SYSTEM.

Among the patents of last week is a reissue of the celebrated Gaulard and Gibbs fundamental patent on the alternating-current transformer distributing system, the original of which was granted Oct. 26, 1886. A comparison of the original patent with the reissue shows that the claims are identical, and also the language of the specifications, with the notable exception of one sentence. This sentence in the original consists of an apparent disclaimer confining the manner of connection of the transformers to line to that shown in the illustrations accompanying the specifications, and which only indicate a connection in series with the generator. That this was purely an inadvertence appears probable from the fact that in the preceding paragraph of the specifications the statement appears that the transformers may be connected with the line in "series, multiple arc, multiple series or otherwise." As corrected in phraseology, the disclaimer reads: "The connection of the converters to line except by their high-tension members, which is the arrangement illustrated in the drawings, is not claimed herein." That this amendment was contested seems to be implied in the fact that the application for reissue has been the Patent Office since Aug. 6, 1889. The effect of the reissue is to broaden the patent, the life of which ,however, is not extended beyond the original term.

It is interesting to note some points in the history of the Gaulard and Gibbs system of electrical distribution, which was well developed several years in advance of the date of the 1886 patent. In the issue of this journal dated Nov. 29, 1884, a translation of a communication of M. Lucien Gaulard to *La Lumiere Electrique* appears, which gives an account of a trial of the system during the progress of the Turin Exposition of that year, and resulting in an award from the Italian government to the inventors of a prize of 10,000 francs. The railway stations of Venario, Lanzo and Turin were illuminated over a circuit of 49.7 miles, the latter with 34 16-cp, 48 8-cp and one arc lamp; the Lanza station with 25 incandescent lamps, a "Sun" lamp and two arcs, and the first-mentioned station with two arc lamps. The communication also refers to the satisfactory experience with the system as installed on the Metropolitan Railway of London, which at that date (Oct. 15, 1884), was stated to have been in operation for six months.

The principal object of the communication referred to was to answer criticisms of Marcel Deprez condemning the invention as neither novel nor patentable, as containing no scientific value and being susceptible of no industrial application. With his usual assurance, Deprez claimed priority with respect to the transformer, but Gaulard pointed out the new and fundamental principles introduced by himself which differentiated his apparatus from the induction coils with which it had been classified, consisting notably in the symmetrical arrangement of the primary and secondary coils with respect to each other and with the magnetic field. Tests were adduced showing that the open magnetic circuit type of transformer gave an efficiency of 89 to 90 per cent. M. Deprez also condemned the alternating current as dangerous, though himself an advocate of high voltage direct currents, and added that the working of lamps from a transformer would be compromised by the extinction of a single lamp. In answer to the latter criticism, M. Gaulard showed a correct knowledge of the inducing actions in a transformer. In a review of the Gaulard and

Gibbs system, the *Electrical World* of Feb. 7, 1885, gives illustrations of the open magnetic circuit type of transformer, which contained a movable core for purposes of regulation. It may be added that in the 1886 patent the statement is made that it is preferable to unite the ends of the cores to form a closed magnetic circuit. The review concludes with a favorable opinion as to the applicability of the system to lighting, but points out the absence of a motor to enable it to be applied to power purposes, though calling attention to the claim of the inventors that this object may be achieved by transforming the alternating to direct current and employing direct-current motors.

In view of the great part which Lucien Gaulard played in the development of the alternating-current system, the misery which poverty brought on the last years of his life is sad to contemplate. His remains were consigned to the common fosse, and last year—the ten years of repose allowed there having expired—the bones would have been gathered and cast into a pit, there to commingle with those of other unfortunates, had not at the last moment an individual final resting place been secured with the proceeds of a subscription.

ELECTRIC TRACTION AND THE DISTRIBUTION OF HOMES.

Although the official returns from the recent census will probably not be forthcoming for some little time, preliminary unofficial returns seem already to have been published pointing to a total population in the United States of seventy-nine millions. If the figures are even fairly reliable, they show that while the last decennial rate of increase for the country at large has been a little more than 25 per cent, the rate of increase in two dozen of the largest cities has averaged 40 per cent. This clearly means, as has indeed been apparent for a long time, that the open country is gaining but slowly in density of population, while mankind jostles into cities. It seems, however, that leaving offices, stores, and houses of business out of consideration, the density of urban population is not increasing, while in some cases it has of recent years been decidedly diminishing. This means that the city limits, or areas covered by dwellings, increase as fast as the urban population. Other things being equal, this involves a greater average distance between the workman's dwelling and the workman's work, and an increasing cost in time, or money, or both, in daily performing the double journey, seeing that the factories do not multiply to reach the laborer, but, on the contrary, rather tend to segregate and combine into single buildings. If this tendency were unchecked, it would result in the overcrowding of the manufacturing districts, and perhaps also in check to some extent the influx of population to the cities. Electric traction, however, has been potent to give cheap and rapid transportation during the last decade. Moreover, the American plan of making uniform charges for all distances up to the limit has enabled the workman to fix his residence within a considerable radius of his work, thus tending to avoid the evils of overcrowding. Rents have in the same manner been averaged and rendered much more nearly uniform than they would be if electric traction did not exist. Add to the list of advantages the greater cleanliness of streets incident to the displacement of the horse to so considerable an extent, and the blessings bestowed by electrical engineering on daily life are fully manifest.

It would seem that the population of the United States increased at the rate of one-third every decade from the beginning of the nineteenth century up to the civil war; and that since the war the rate has been about one-quarter every decade. If this rate were maintained the population of the United States would be one hundred millions in 1910, and nearly 750,000,000 in 2000. There is, fortunately, reason to believe that it will not be maintained. We say, fortunately, in view of present conditions of sustenance, and with an agriculture unelectrified.

MAXIMUM EFFICIENCY IN TRANSFORMERS.

In our last issue we printed an article on this subject by Mr. F. G. Baum. The gist of the demonstration is that for any given transformer operated, in the ordinary way, from constant-pressure mains, the efficiency will be nearly a maximum at the load which makes the copper and core losses equal, the maximum being reached at a slightly lower load than this.

This follows at once, in fact, almost by inspection, from the assumption that the output varies directly as the secondary current, while the input is the sum of the output, a constant loss in iron and a loss in copper which is variable, but which is proportional to the square of the secondary current. The ratio of output to input; or, otherwise expressed, the efficiency, will then be a maximum when the secondary current and load are such as make the variable copper loss equal to the fixed iron loss.

The assumption that the output varies as the secondary current is not quite true, because it requires constant secondary pressure or perfect regulation, which we are yet unable to secure. Constant core loss is also not quite true, but very nearly. Loss in the copper as the square of the current would be true if the exciting current vanished and the temperature were maintained uniform. In spite of these little errors, however, the rule is practically reliable.

There is always a danger in the blind worship of a broad generalization, and a pitfall attends the feet of the unwary student who absorbs this law of transformer efficiency without sufficient reflective pabulum to render the rule mentally digestible. There is no escaping the fact that as load is added to a transformer, the efficiency will rise until the losses in copper and core are nearly equal; but it does not follow at all that such a load would be the best load for the transformer to carry. It would only be the best load on the assumption that the transformer is merely a machine for yielding the best output for a given intake. It is true that a good transformer must be economical in its work, but the pressure regulation and the coolness of the machine may impose limitations that do not appear in the original premises. Thus, many large transformers are operated in practice at a load much below that given by the rule; for the reason that if the load were pressed to the point of maximum efficiency, they would either overheat, or would fall off in secondary pressure beyond the proper limits. This only means that their efficiency is already sufficiently high to meet all requirements, without going to the limit, and that it is still rising at full load.

The conclusions are modified if instead of taking the transformer ready-made and completely wound, we assume a given load and take the core, only with a definitely limited winding space, and determine the winding which shall give the maximum efficiency at that load. In this case, as Mr. Carter showed in a paper read before the Institute last year, the wire should be so chosen as to make the copper loss equal to the eddy-current loss plus 80 per cent of the hysteresis loss. As the hysteresis loss is commonly from three to five times as great as the eddy-current loss, this rule is not materially changed from the simple equality of copper and iron losses. If, however, transformers were designed strictly according to this rule in order to secure maximum efficiency and to the disregard of heating, regulation, cost, weight and shape, there would have to be a considerable change in many of our commercial forms. This is only another way of stating that efficiency is admirable, but efficiency worship may readily transgress the limit between zeal and fanatic indiscretion.

Fourth Annual Convention of the Pacific Coast Electric Transmission Association.

The fourth annual convention of the Pacific Coast Electric Transmission Association was held at the Tavern of Mount Tamalpais, near San Francisco, on Tuesday and Wednesday, June 19 and 20. The attendance was larger than any previous convention, and the place of meeting was voted the most pleasant.

Tuesday afternoon the first meeting was called to order by the president, Prince Poniatowski, who made a short address, expressing the hope that it might be possible to have meetings quarterly, reserving the annual convention for the most important papers and discussions. Before closing his address, he presented each member of the association with a souvenir gold button. The name of the association is in gold letters imbedded in a field of blue surrounding the centre, which consists of an etching in gold showing the top of a pole with cross-arms, upon which are mounted three high-voltage insulators with the wires in place.

The first paper was "Regulation in Long-Distance Transmission Plants," by F. A. C. Perrine. In the absence of the author, the paper was read by F. V. T. Lee. The paper discussed the use of multiple water wheels on large units operating under high heads, methods of governing and other hydraulic problems. The present application of high voltages for very long lines and the resulting capacity current were mentioned; the use of regulating impedance coils was recommended at the receiving end to assist in good regulation. The use of an impedance coil for such work was mentioned as having been devised by Mr. F. G. Baum in connection with the regulation of voltage in the Stockton sub-station of the Standard Electric Company. At the suggestion of the president, the discussion of this paper was postponed until after the reading of a paper on a similar subject set for the next day.

The paper, "Lighting for Interior and Street Service, in Connection with Power Transmission Plants," by H. W. Hillman, was read by F. M. Ray. The many advantages of the alternating-current enclosed arc lamp were brought forward in a clear and concise manner, particular reference being made to the series operation of such lamps using a regulating transformer, a higher gross efficiency, less cost for trimming and carbons; and a smaller number of "outages" were claimed for the enclosed lamp as compared with the series direct-current open arc.

The discussion of this paper showed the general use of the enclosed arc lamp in connection with many California transmission systems. The deposit of carbon dust on the inner globe as affecting the candle-power, the fact that this deposit is much less with the alternating-current lamp than with the direct enclosed arc, and also the power factor of the alternating arc lamp, were given consideration by a number of the members who had been using this type of lamp. A further point of some importance was brought out that while the illumination directly under the lamp was not so good as in the open arc, yet at some distance the light is better using the alternating enclosed lamp than with the open direct-current series type.

"Recent Developments in Transformers for Transmission Service" was the subject of a paper by H. C. Wirt, which was read by the secretary, Mr. Low. The marked advantage of low core loss and the effect of excessive high temperature on the ageing of transformer iron was considered from a practical standpoint. The discussion which followed brought out the experience of many of the members with oil-insulated transformers as compared with those of the air blast or natural draught type. One very important defect which it was thought should be overcome is the deterioration of the insulation in transformers after continuous use, particularly those of the oil type when there is a possibility of carbonization.

R. S. Masson presented a paper on "The Choice of A. C. Motors," which was read by W. W. Briggs. The paper treated of the comparison of synchronous and induction motors, especially their operation under particular circumstances. The opinion of the author was in favor of the use of induction motors wherever possible as being more convenient, the number of operations on starting being less than with the synchronous motor, and more simple in general operation.

Many cases of the use of induction and synchronous motors were mentioned by the members in the discussion of this paper. Induction motors are very largely used in pumping in sizes from 20 to 100 horse-power. Both types of motors are used in mining work for driving air compressors, pumps and stamp mills. The general conclusion seemed to be that while the synchronous motor has given excellent service in sub-stations, the induction motor has many advantages for general use in mines and such places where expert attendance is not available.

"The Application of Storage Batteries to Transmission Systems," by C. O. Poole, was the first paper presented at the evening session on Tuesday. Typical load curves were thrown on the screen and the part of the load taken by the storage battery shown. The advantages incident to the use of storage batteries in connection with regulation was considered an important matter in long-distance transmission, also rendering it possible to repair lines without interruption of service. The storage of energy in the form of water in reservoirs was suggested in the discussion as also possible, and in some cases less expensive than the use of storage batteries.

Marsden Manson gave an illustrated lecture upon "The Factors Determining the Water Supply of California," which was of much interest to those developing transmission systems. The origin of storms on the Pacific coast, the annual rainfall in California during the last 50 years, and the effects of forest preservation were points given clear explanation. While not in line with the ordinary electrical papers, the relation of the subject to the development of long-distance transmission made the lecture of much value to those present. Following Mr. Manson, the stereopticon was used to great advantage in exhibiting slides from representative electrical transmissions in California and on the Pacific coast. Views were also shown by a number of manufacturing companies of water wheels, electrical machinery and other transmission apparatus.

The session on Wednesday morning began with the reading of a paper by Prof. C. L. Cory on "Transmission System Regulation." This paper considered the problems in connection with the transmission of power over a distance of 150 miles. The treatment had particular application to the system now under construction by the Standard Electric Company of California.

In the discussion which followed, the value of induction motors in reducing the leading current on long lines was clearly shown. Artificial regulating impedance coils may be used to accomplish the same result. On the 83-mile, 33,000-volt transmission line of the Southern California Power Company from San Bernardino to Los Angeles, the heavy charging current has been largely neutralized by distributing induction motors for pumping purposes at points along the line.

Measurements were reported as having been made of the charging current on the 62-mile, 20,000-volt line of the Yuba Power Company, which agreed very closely with the computed charging current as shown in the paper, taking into consideration the increased distance shown in the paper.

"Atmospheric Electricity" was treated by Alexander G. McAdie, giving the results of his recent experiments in connection with the flying of kites at altitudes approximating one mile and the photographing of lightning discharges. His paper was followed by one on "Rate Indicators," by Howard Hendrickson, which was read by the secretary. He describes a recently-patented meter of his own invention, similar to the Wright demand meter.

In executive session on Tuesday afternoon the following officers were elected for the ensuing year: President, Prince Poniatowski, of the Standard Electric Company; vice-president, Dr. Chas. VanNorden, of the Central California Electric Company; treasurer, William Angus; secretary, George B. Low; executive committee, C. P. Gilbert, of the Standard Electric Company, and E. J. DeSabla, of the Yuba Power Company. The annual banquet was held Tuesday at the Tavern of Tamalpais.

International Electrical Congress.

The International Electrical Congress at the Paris Exposition will be opened at 10 a. m., August 18, in the Palais des Congres in the Exposition grounds. The succeeding sessions will be held in the building of the Société d'Encouragement, 44 Rue de Rennes, facing the Eglise St. Germain des Pres. A membership card gives admission to the Exposition during the session of the congress. Membership cards will be distributed in Paris as follows: From Aug. 6 to 18, 14 Rue de Stael; Aug. 18, Palais de Congres, and afterwards at 44 Rue de Rennes. Members who desire to obtain a reduction of 50 per cent in railroad fares on French railroads should communicate before July 9 to M. P. Janet, secretary of the congress, 14 Rue de Stael, Paris, indicating exactly the itinerary. Those who desire to join the congress may yet do so by remitting the fee—20 francs—to M. P. Janet. All members will receive a printed copy of the proceedings of the congress when issued.

Electric Lighting of Railway Trains.

BY GEO. D. SHEPARDSON.

THE Chicago, Burlington & Quincy Railroad was one of the first to experiment with the electric storage battery for train lighting. In 1886, a car in suburban service at Chicago was equipped with 30 accumulators of the Julien type, costing $22 each. At that early date, the battery was still in the experimental state, and lacked the durability and reliability of later types. The electric light was found to be so much more expensive than oil or gas, that the experiment was abandoned. After eleven years, the company took it up again, and with marked success.

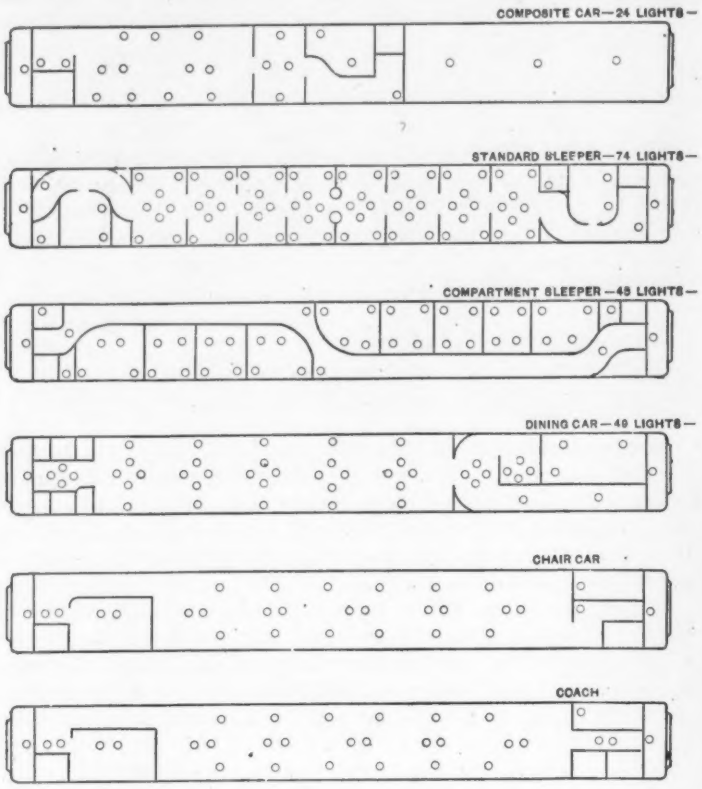


FIG. 1.—LOCATION OF ELECTRIC LAMPS (SIX CARS).

As the writer has discussed elsewhere (*Proceedings* Northwest Railway Club, May 1900), the electric lamp has certain advantages that make it peculiarly desirable for train lighting. Its freedom from dripping and smell, smoke and other products of combustion, open flame and danger from fire, and its uniformity, reliability, flexibility and general adaptability, render it almost essential for train lighting, where passengers demand both safety and comfort. For berth lighting, it has a field all its own, and the traveling public, having tasted the luxury of a train equipped with electric lights, ventilating fans and toilet accessories, is satisfied with nothing less.

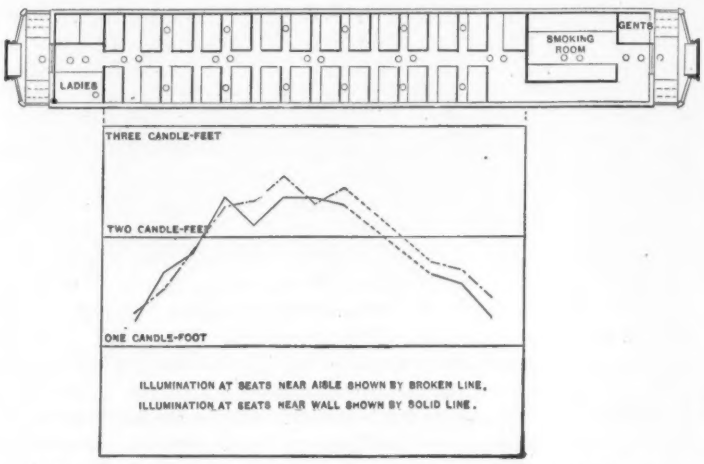


FIG. 2.—PLAN OF COACH AND ILLUMINATION CURVES FOR SAME.

The question of relative expense of electric and other lights is of more importance to the railway managers than to the public, since in the competition for business the former must supply what the latter demands. In America, it is generally believed that electricity costs more than oil or gas, although some claim that electricity is cheaper than either for equal amounts of light. The writer believes that with batteries charged at terminal stations under the best conditions, the total cost of lighting a train by electricity is less than by gas. It may possibly be reduced in the case of trains whose batteries are charged from dynamos driven from car axles, and probably yet more by making certain structural changes in the batteries. Even under the unfavorable conditions where a charging plant serves the batteries of only a single train, the cost is not excessive.

There are several systems of supplying current for railway trains, and each has its own field, being best suited for certain conditions. No one system is best for all. For solid through trains, such as those running between Chicago and Minneapolis, the ideal conditions prevail for the use of storage batteries. The night trains stand in the yards all day, and, while the car cleaners and inspectors are doing their work, the batteries can be charged without being removed from the cars, and without holding the cars from service a single moment. All handling of the cells, except as required for repairs or cleaning, is avoided, thereby removing one of the most prolific causes of deterioration found in some earlier attempts to use storage batteries for train lighting, as it was found that a single removal and replacement of the battery injured it more than a thousand miles of travel. In the case of the limited trains leaving in the evening and arriving in the morning, the battery is at its best; for when the train starts, the batteries have just received their charge, and the voltage is high, so that the lights are brightest when most needed.

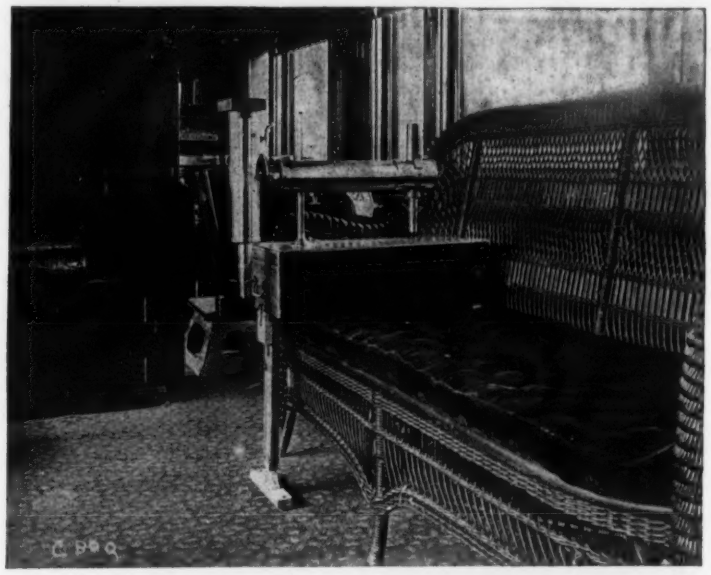


FIG. 3.—PHOTOMETER ON CAR SEAT.

In the endeavor to secure a larger share of the travel between Chicago and the "Twin Cities," St. Paul and Minneapolis, the Chicago, Burlington & Quincy road in June, 1897, put on the "Burlington Limited," to eclipse every competitor, it being the latest and best product of the Pullman Palace Car Company. As the train stood in the Union Station at Chicago ready for its maiden trip, Mr. Geo. H. Pullman, president of the manufacturing company, was heard to remark that they were "the finest cars that ever stood on wheels." Well they might be, for the train cost over $100,000, and no expense was spared to surpass everything else. The fact that there are no less than 18 trains daily in each direction between these great centres of population and trade, indicates the rivalry among the six competing lines. As the distance between Chicago and Minneapolis varies from 410 to 480 miles on different roads, while the minimum time and rates are maintained by agreement among the competitors, it follows that the travel tends toward the best trains.

The "Burlington Limited" has now been in service for three years, and a description of its electrical features may be considered as presenting successful practice rather than as a trade announcement of intentions and promises. Each train consists of five cars: a composite baggage and buffet car, a standard sixteen-section sleeper, a compartment sleeper, a reclining-chair car and a coach. As one train

leaves Minneapolis in the evening, its mate leaves Chicago, each making the trip in fourteen hours. A dining car running between Chicago and Oregon serves dinner out of Chicago on one train, and returning in the morning serves breakfast for its mate. On the northern end of the line, a sleeper and chair car for St. Louis are attached to the train between Minneapolis and Savanna. A closed express car also runs between Minneapolis and Chicago. All of the cars, except the express, are equipped with Pintsch gas, and those running between Chicago and Minneapolis have also incandescent electric lamps supplied from storage batteries carried in boxes beneath the car.

The decorations were specially designed for this train, and there is a pleasing variety in different parts of the train. The buffet and library car is finished in inlaid vermilion wood with empire green furnishings. The standard sleeper is finished in East Indian vermilion wood, which forms the ground for an inlay of six different-colored woods, the ceiling and upholstering being of royal blue. The compartment sleeper is finished in Circassian walnut, vermilion and different varieties of mahogany forming the groundwork for inlaid work similar to that in the standard sleeper, each compartment having a distinct scheme of coloring, with upholstery and carpet to match. The chair cars and day coach are finished in mahogany inlaid with satinwood and tulip, seats being upholstered in royal blue to match the ceiling, which is trimmed in gold. The cars are connected by steel platforms and vestibules 2½ ft. long and 9 ft. wide, each vestibule being lighted by gas and electric lamps.

The combination of centre and side lights throughout the train gives a pretty effect. Each car has a number of Pintsch gas fixtures near the ceiling above the aisle, these being surrounded by two or four incandescent lamps with suitable fixtures and shades. The gas lamps in the main body of each car have four burners, while those in the passages and vestibules have two. When the trains are in the terminal stations, all of the lamps are lighted, but on the road the gas is extinguished as being superfluous. The buffet car has four gas lamps, each with two electric lamps, also nine electrics on handsome side fixtures near the writing desk and side seats. The standard sleeper has groups of four electrics with each of the eight gas lamps, and each of the sixteen sections has two berth lamps. Each room in the compartment sleeper has a four-burner gas lamp with two electrics on the ceiling, and also two berth lamps. The dining car has eight four-burner gas lamps, each with four electrics, and also has ten electrics along the sides, one near each table. The chair car and coach originally had eighteen and nineteen electric lamps respectively, with seven and eight Pintsch lamps, but these have been re-enforced by twelve electrics arranged along the lower part of the ceiling on both sides, as shown in Fig. 2, giving a plan of the coach.

The excellent illumination in the cars is indicated by the accompanying curves, Fig. 2, taken from measurements in the main body of the day coach by W. L. Kinsell and F. G. Tracy, senior students in the University of Minnesota. For this purpose, a Weber portable photometer was fitted with suitable attachments, Fig. 3, so that it could be placed on any seat of a car for measuring the actual illumination at points were passengers are wont to read. A series of tests reported in the paper already cited, showed that the light falling on a horizontal surface agreed closely with the average in the positions where passengers hold reading matter, and this position was adopted as most accurate and also most convenient. The photometer was placed in two positions on each seat along one side of the car, measuring the illumination for the passengers sitting near the aisle and for those sitting near the outside wall. The circles at the top indicate the location of lamps. Those on the curves show the location of the seats. Vertical distances indicate the illumination in candle-feet, the strength of the light one foot from a standard candle being taken as the unit. The minimum illumination in this car was 1.25 candle-feet, and compares favorably with that in similar cars tested elsewhere. The combination of centre and side lights gives an illumination more uniform than is common, and makes reading comfortable in any part of the car.

The berth lamps used in the sleepers improve the appearance of the car and also add much to the convenience of the passengers. Each berth has two sockets where lamp fixtures may be attached or removed by the porter, as desired. Each socket is provided with a key so that the passenger can light or extinguish the lamp at will. The berth lamps are frosted, so as to diffuse the light, and thus avoid the glare frequently found with clear globes, making it possible for a passenger to read in comfort anywhere without the necessity of searching for a position where he can have abundance of light and not be troubled with the glare noticeable with some other devices.

Besides the electric lights, the train is equipped with other electric conveniences that are appreciated by travelers. An electric fan helps ventilate and cool the buffet car, and two of them assist in making the dining car delightful. There are also electric curling-iron heaters in each room of the compartment sleeper and in the ladies' dressing room of the standard sleeper. The ladies thoroughly appreciate these luxuries, that can only be used on trains equipped with batteries, for the dynamos used for lighting similar trains are shut down in the morning at the only time when the ladies need such accessories. An incandescent lamp has also been placed in the icebox and cigar case in the dining car, where a light is useful even when other lights are not desired. A handsome transparency which is illuminated by twelve incandescent lamps is attached to the rear platform to advertise the train as the "Burlington Limited," and not only attracts attention to the train as it stands in the union depots, but also adds to its scenic appearance as it speeds across the country.

The incandescent lamps on the ceilings are generally of 16 candle-power and the side and berth lamps are of 12 and 10 candle-power. The total lighting of the train, exclusive, of gas, is as follows:

Buffet car	24	lights	aggregating	368	candle-power.
Standard sleeper	74	"	"	824	"
Compartment sleeper.	45	"	"	576	"
Dining car	49	"	"	640	"
Chair car	30	"	"	408	"
Coach	31	"	"	420	"
Transparency	12	"	"	120	"
Total for train.....	265	"	"	3356	"

After a careful study of the conditions, the officials of the Burlington road decided that the system best adapted for their limited trains between Chicago and the Twin Cities was to use storage batteries charged at the ends of the line. Each car was therefore equipped with forty-eight cells of the Pullman and American type. The plates in the two kinds of battery look alike (see Fig. 4), the American being a pasted plate, while the Pullman is formed electro-chemically by the Planté process. The cells are rated at 160 amp.-hours, and each weighs about 56 lbs. Each cell contains four positive and five negative plates, each plate being 7 ins. high, 6 ins. wide and ½ (American) or ⅞ (Pullman) in. thick. The plates rest on treated wooden supports, clearing the bottom of the containing cells by about three-fourths of an inch. The hard rubber containing cells are 11 ins. high and 6½ ins. by 6¾ ins. wide, giving only one-quarter inch clearance between plates and cell. At first it was feared trouble might be caused by slopping of the acid when the train started or stopped suddenly, but by using deep cells extending about three inches above the tops of the elements, and by having little clear space on the sides, no trouble is experienced from that source. The 48 cells under each car are connected in series through rubber-covered flexible copper cables, and very little trouble is experienced from loose or broken joints. For convenience in handling, six cells are placed in a tray or crate with hardwood rollers and suitable handles. Four crates are placed in each of two boxes under the car floor, Fig. 5, one box being on each side, to equalize space and weight. When the train is on the road, the boxes are closed tightly by cover lids hinged at the bottom, but when the batteries are charging, the covers are dropped to allow the gases to escape freely. Practically no trouble is caused either by fumes when charging or by entrance of dust when on the road.

On some of the cars, ammeter jacks are placed near the battery boxes to facilitate measuring the charging current taken by each car. The battery terminals lead to one of the closets in the car to a cabinet containing switches and fuse blocks for the two or more circuits of the car, and also two clips for voltmeter connection to facilitate testing the condition of the batteries. Three cables, No. 00 B. & S. G., run the entire length of the train, being connected between cars by flexible couplings at the tops of the vestibules. One of the couplings is shown assembled and in parts in Fig. 6. All the battery circuits and lighting circuits are connected across two of the cables, thus equalizing the discharge of the batteries, however the loads in the individual cars may vary. When charging, the dynamo is connected between the two outside cables, as indicated in the sketch of the train wiring, Fig. 8, so that each battery is charged at practically the same pressure.

When the train arrives at the terminus, the electrician removes the cable couplings between the cars, so that each car may be lighted from its own battery. All the lights are then turned on and the voltage or the appearance of the lights is noted to see that the batteries are in good condition. The failure of any cell is thus readily detected

and the cell replaced. The flexible couplings between the cars are then replaced and the charging current is turned on, the lamps, of course, being turned off while the batteries are charging.

In Minneapolis, the batteries were formerly charged from the Edison commercial circuit, but the line pressure of 108 volts was found to be too low to charge them fully. A Westinghouse 20-hp

FIG .4.—CLEANING BATTERIES.

gasolene engine belted to a Westinghouse 11-kw, 125-volt dynamo was then put in, and has operated satisfactorily ever since. As the train comes in, the batteries give from 93 to 97 volts on open circuit, and from 80 to 92 volts with all lamps turned on. At Minneapolis, the charging begins with 85 amperes at 110 volts, increases to 100 amperes at 115 to 130 volts, and then drops off to 85 amperes at about 132 volts. An average charge is shown in Fig. 9, which gives the input for June 15, 1900. The charge during the winter months is somewhat larger, since the lamps are then used a short time in the morning.

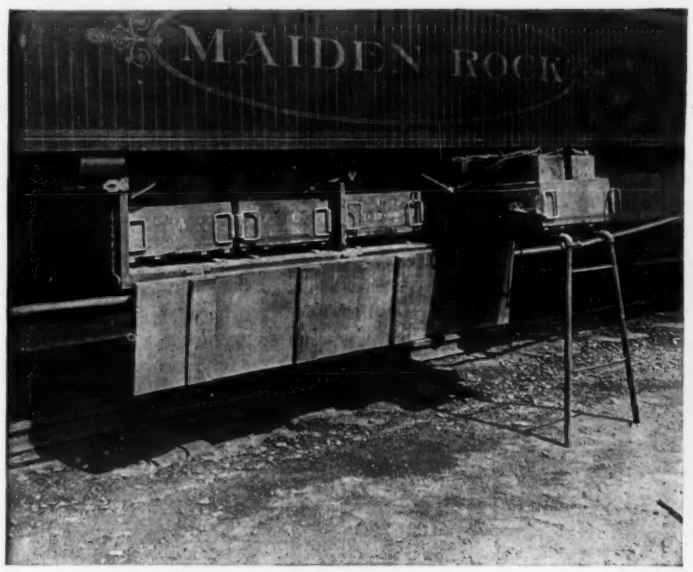


FIG. 5.—BATTERY BOX UNDER CAR.

In Chicago, the batteries are charged from a Westinghouse generator of 17 or 25-kilowatts belted to a Westinghouse 65-hp standard steam engine in the Twelfth Street round-house. Since the train lies in the Chicago yards two hours shorter time than at Minneapolis, the batteries are charged at a higher rate, beginning with 115 amperes at 115 volts and ending with 120 amperes at 136 volts. The charging stops about an hour before the train starts, allowing the temporary excess polarization to die away, so that the terminal voltage is about 98 when the lamps are first turned on. With all lamps lighted, the voltage soon falls off to about 97, so that the lamps are not strained for any considerable length of time. Since the number of lamps in use drops off during the evening, and the rate of discharge diminishes accordingly, the voltage remains nearly constant all night, and no kind of regulation is required to maintain practically constant voltage on the lighting circuits.

The charging at Minneapolis is under the care of the yard foreman, who devotes about three hours per day to this part of his duties. At Chicago, an electrician and helper attend to the testing and repair

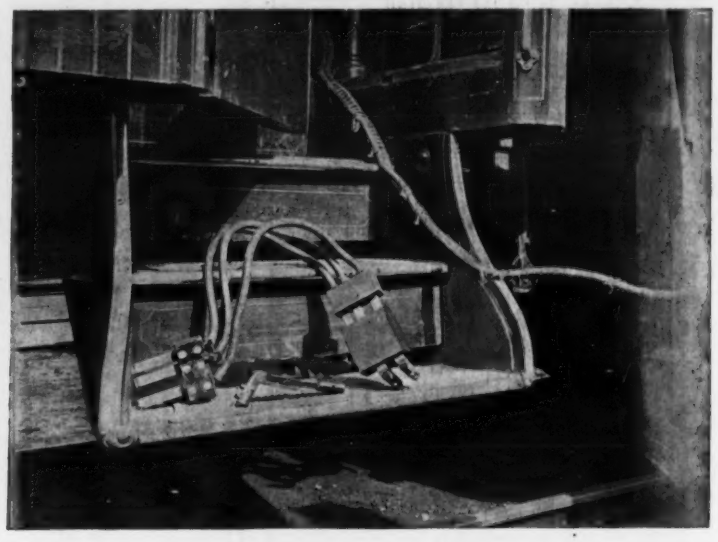


FIG. 6.—CABLE COUPLER.

of batteries and look after the train-heating equipment, while the engineer attends to the charging and performs some other duties about the round-house.

About once a month the cells are removed from the cars for thorough inspection and washing. At such times a deposit of mud from one-eighth to one-half-inch deep is removed from the bottom of each jar. In setting up the cells, acid with specific gravity of 1.150 is used. For convenient handling of the batteries, a truck of just the right height is drawn up close to the side of the car, so that the battery trays may be rolled out upon it, and thence to suitable platforms. A spare

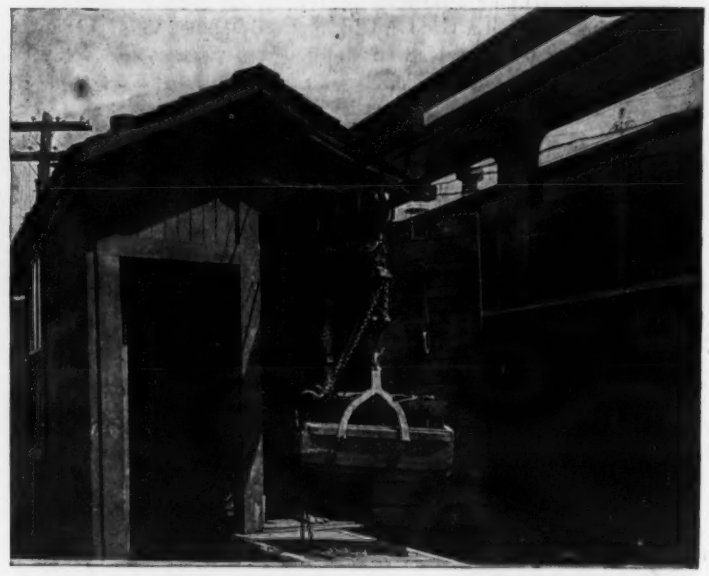


FIG. 7.—CRANE FOR HANDLING BATTERIES.

battery is kept in readiness in the electrician's quarters, the trays being handled by means of a chain block on an overhead track, as shown in Fig. 7.

The excessive weight of storage batteries has been urged as a serious objection to their use for lighting railway trains. As a matter of fact, with the heavy vestibuled trains now common, the weight of the battery averages less than 2 per cent of that of the car it serves, so that this objection has little force.

After an experience of three years with the batteries, the master mechanic, who has charge of these trains, is convinced that electricity is far superior to other methods for lighting trains, and that the battery system is more economical than the engine and dynamo

outfits used in competing trains by their enterprising rivals, the Chicago, Milwaukee & St. Paul and the Chicago, Minneapolis, St. Paul & Omaha roads.

In closing this account of the "Burlington Limited," the writer de-

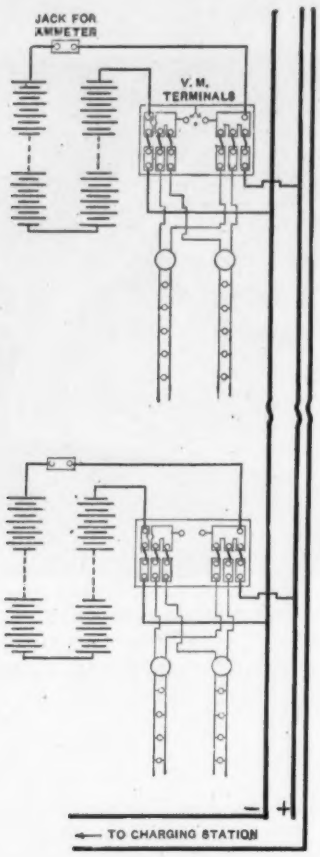


FIG. 8.—DIAGRAM OF CAR AND BATTERY WIRING.

sires to acknowledge the courtesies shown by the officials and other servants of the road in La Crosse, Chicago and Minneapolis, through whose aid he has been enabled to compile and present the accompanying data on a subject which he deems of interest to the profession in general.

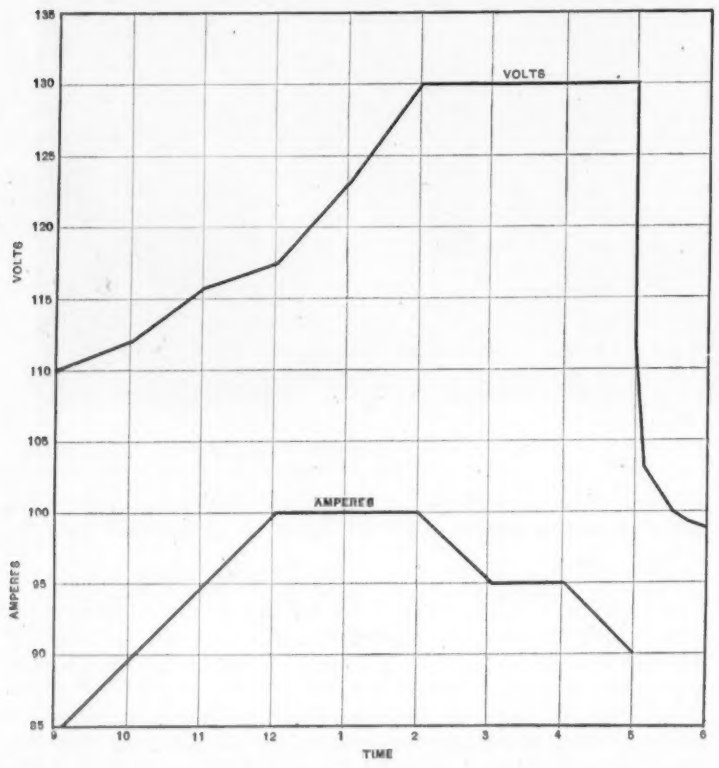


FIG. 9.—CURVE OF BATTERY CHARGE.

Opportunities for Establishment of Electrical Plants in the Philippines.

BY G. D. RICE.

THERE is a very good opening for the establishment of electric light systems in the Philippine Islands. The writer recently returned from an extensive tour of the southern islands, including all of Panay, and portions of Negros, Cebu and Mindanao, the principal islands of the Philippine group aside from Luzon. In Luzon, which is, of course, the most important of all, there are already many electric lights in operation in Manila, and in the chief coast cities.

While Spain had control of the islands, the idea seemed to be to keep everything back, it being stated that she would not permit even the rich owners of sugar plantations, rice fields, etc., to purchase modern machinery for working their products, and the woods of the Philippines have been neglected for generations for the same reason. As soon as the Americans have taken a city, town or barrio, they go to work and put the same into American condition. In some sections the process of Americanizing has progressed at a remarkably rapid rate, and to-day men and women who were practically in a savage state are asking for the modern improvements of America, such as sewing machines, bicycles, modern machinery for handling the immense forests of valuable woods, machinery for working sugar, tobacco packing, electric roads, lights, ice-making machines, etc. There are many rich men here, and if an American were to come here with the proper models and plans for the introduction of an electric power station for lighting the community, at such a place as Iloilo, Negros or Cebu, he would find no lack of money for the enterprise.

At present, outside of Manila, the only means of lighting is with petroleum oils shipped into this country from Russia, England and the United States. Most of the packages of illuminating oils appear to be stamped as from Russia. The cost of the oil by the time it reaches the consumer in these islands is very great as compared with ordinary American values. The result is that the poor native families go without oil light and burn wood, or do without light at all. The moderately well-off people use about one lamp for a household, while the rich, of course, burn oil as they please. The Americans and foreigners here use imported American lamps and burn what oil is needed.

Although there are no means of getting gas for illuminating purposes in these native cities and towns, vast gas wells exist in the mountain ranges. At one of these, in a section of the country where they said white man had never been before, I put bamboo poles in the earth and lighted the gases as they came from the top, producing a steady, clear and strong flame. At another place I found indications of oil wells. These wells have been found in various parts of the islands, and may in time amount to something. At present they are useless.

What is wanted here is a system of electric lighting, and it is bound to come very soon, for everything is inclining that way. One of the first thoughts in connection with the establishment of electric light systems in a new country concerns the power. Steam power is available, of course, but the cost of getting a steam plant of large size to these islands will be expensive. However, it can be done, and has already been done by manufacturers of ice, woodworkers, machinists and others; but up in the mountains of Panay—and the same conditions exist in nearly all of the important islands—there are certain water-powers which could be developed by collecting several streams into one body and carrying the latter to a given point in the valleys for use for operating water wheels. The opportunities for putting in open flues and tunnels for the purposes of carrying the water the required distance are favorable, as there is plenty of good timber available, and native labor on this sort of work is exceedingly inexpensive. The waters gathered at these elevations could be carried to the sea level, or to the desired points at the seaport cities, and there utilized in the operating of the power plant.

Some would, of course, favor a steam power plant, and if such a plant is put in, the power development should be greatly in excess of what is needed, and the surplus power rented to the many machinists, wood-working establishments, sugar plants, etc., which are now operated by caribou power in all of the cities and towns at the seaports, and often in the interior. The caribou is a big, steady and strong animal, very slow in action, but can take a heavy load behind him for long distances. These animals are secured to the walking beams of turning-power devices in the shops, and in that way a very irregular,

slow and unsatisfactory power results. The few manufacturers and others who are fortunate enough to possess steam-power plants have only what power they themselves need, and will not rent any of the power. There is, therefore, a great demand for power, and an electric-lighting power company could derive a good income from the renting of power to small parties.

The power plant of the electric light station can be operated cheaper in this country than in America, for the reason that the cost of labor hire for all but the chief engineer and the fuel account are much lower. The head engineer and machinist would have to be engaged in America, and brought here to supervise the erection of the plant and later on to take charge and instruct natives in firing and to act as assistant engineers. These native assistants and firemen can be secured for the regulation rate of wages of 20 to 25 cents per day of American money, and they live well and save money on these wages, although they support themselves and provide themselves with lodgings out of it. As to the wood for use as fuel, this is secured from the banks of rivers and streams in abundance after the rainy season, for the high waters carry the broken logs from the woods to the river, and as soon as the river settles, the natives go in with the caribou and secure logs, which they sell in the cities and towns for firewood at the rate of about one dollar gold per cord. This wood makes good stuff with which to raise steam, and it can be bought in vast quantities.

Less than six months ago it would have been unsafe for electricians to go far from the seaport cities garrisoned by American troops for the purpose of putting in electric light wires. Last November the battle of Balangtang was fought in the Island of Panay, immediately after which the insurgents were driven to the hills in small bands and the native army of Panay has since gone to pieces, so that to-day almost everywhere one sees the signal corps men of the United States Army putting in wires for connecting signal stations from one side of Panay to the other. Practically the same conditions prevail in Luzon and the other islands. It is safe for wiremen to go almost anywhere in the islands now, providing that they carry rifles and have with them a small guard. It is customary for the signal corps men to go in squads of about six men each, all armed with revolvers or rifles, and as they operate between posts garrisoned by the United States soldiers, the commanding officer of the station next to them provides as guard about four armed men. The same facilities for protection would be given wiremen who would put in electric wire systems for connecting one town with another. By the time an electric light company were to get to work, the riotous times would be at an end and no guards required. But the American officers of the troops here are always very willing and glad to lend protection to new interests, whether controlled by Americans or natives. If the owner of a sugar plant wants protection from roving guerillas, he is supplied with a squad of men to protect his property, and nobody cares whether he was or was not once an officer or a private in the insurgent army.

Poles for the wires can be secured very cheaply. There are vast forests of excellent woods of all kinds going to nothing in these islands, and fortunes are being lost to somebody every year; if it can be looked at in that way, presumably the time will come when these magnificent forests of great old trees of mahogany, black walnut, etc., will be utilized for something else than ordinary house and table woods by the natives, or permitted to rot in the swampy jungles, as many valuable woods are now doing, for lack of some one to cut them and ship the rich products to the markets. The bamboo poles of the islands are perfectly straight, of course, and the signal corps men have used these in large numbers for stringing the signal wires for telephone and telegraph across the islands. They have the natives cut the poles, and the natives do this sort of work for 15 to 20 cents daily, American money, so that the cost per pole is only a few cents. In getting these poles, an electric light company could go into it deep enough also to cut mahogany and ship enough of this valuable wood to America or other ports to pay for the entire cost of putting in the wires.

An electric light company should not come to the islands expecting that it can string its wires from seaport cities and towns to the interior towns and barrios without considerable labor in getting from one place to the other with the necessary apparatus. The roads of the Philippines, except in the cities and towns, are unfit for service about six months out of the year. The worst time of the year is in November, when the last of the floods due to heavy rains are felt. The roads then become overflowed, unless graded, and the hollow places become soft mud, into which the drag sleds of the caribou and the wagons of the mule trains of the army sink until they are almost put out of service. The writer was with one ration train, which covered only about two miles per day in the latter part of last October because of mud and water. During the dry season, however, the roads get sun-baked and hard and firm, so that the drag-sleds of the natives slide off the surfaces freely and the wheels of the heavy wagons ride easily on the level top. It is during this time, which extends from December to June, that the electric light company should put in its best work in stringing wires.

In nearly all of the cities, towns and barrios of the islands there are certain natives who make a business of caring for the street and house lamps at so much per lamp per night. It is a custom here for all houses and shacks in the communities to have lights, one each, in front, all night—usually a lantern-shaped affair made by the native workers in metal. The cost of burning these lights and the lights used for household purposes may equal almost the entire cost of the food for a portion of the family. It costs only a few cents per day for the rice and simple food for a native. It would be only necessary for an electric light company to put in its plant and wait results. The rich natives would quickly flock into the office and place their orders for lamps, and the business element would follow. The presidentes of the towns would put in the lights for lighting the streets, the church, the market place and other properties under their control. The natives have money for this purpose, and some of them have much of it. The cost of present systems of lighting being high, the slight additional cost for electric lights would not prevent the average native from putting in the same. The natives want everything new and modern, and are fast learning to do things like Americans and to call for things as we do. For example, when the writer arrived here last year, almost all of the natives seemed to be in breech cloth only. The Americans objected to this sort of thing, and made the natives buy white suits and wear them. The natives objected at first, but took it good-naturedly in time. It was an amusing sight to see a big American soldier chasing a little, brown native in breech cloth; finally catching the native and walking him to a tailor's and making him have a white duck suit made. I once saw a soldier march into a tailor's shop with four natives, two held by each hand, by the breech cloth. The natives seemed to take it as a joke and laughed heartily; but they had to get into clothes. Once in clothes, they must have shoes, and then a hat, and so on. Once equipped this way, they never go back, but strut in their new Sunday white clothes, taking pride in them. All this leads to higher and better ways of living, and to a desire for things modern, such as electric roads and lights; so that the present conditions for the establishment of electric light and power systems in these islands are very favorable.

There is a great deal of capital here in the possession of the rich natives ready for investment. I have had the wealthy classes in all sections come to me and ask advice concerning the investing of gold and silver money, which has been stored in chests in the earth beneath houses in the islands for a long time. Some of this money is badly tarnished, but is all right for circulation. The rich native sugar mill owners and others never dared invest money to any extent under Spanish rule, for they feared that as soon as it was known that any one had money to invest, Spanish officials would get hold of it in some way. Nor was it safe to put money into manufacturing enterprises, or even the banks. There is one bank in Iloilo and several in Manila. If the native merchants carried much of a stock of goods, there was danger of its being confiscated or taken by the warring tribes of the islands, and consequently no one carried much of a stock of anything. I recollect when first coming to the islands, at Molo, on Panay, there were reports of attacks by the insurgents one night and a riot started; and as the frightened people rushed through the streets, certain of the rough native element stole all the goods they got hold of in the stores and rushed along with the mob to the outskirts of the town, there to take away the goods to the mountains. This sort of thing discouraged any one from establishing new works. But now that American troops have practically cleared the territory of the rowdy element and compelled the warring soldiers of the insurgent army to put aside their weapons and go to work at the plow or the bench, the situation has so changed that it is perfectly safe for an enterprising American to start electrical works in these islands.

The Washington Monument.

Is hereafter to be operated by electricity. It costs the government at present about $20,000 a year to take the public up the 500 feet to the top and down again. The Sundry Civil Appropriation bill approved June 6, included $20,000 for one dynamo and connections, and installation of new system, and $6,500 for an addition to the boiler house.

Summer Convention of the Northwestern Electrical Association.

The summer convention of the Northwestern Electrical Association was called to order by President Pliny Norcross, at Grand View Hotel, Chain O' Lakes, Waupaca, Wis., Tuesday morning, June 26. In his opening remarks Mr. Norcross spoke in eloquent terms of the locality selected for the meeting place of the convention. Mr. Gerhard N. Dahl, city attorney at Waupaca, welcomed the convention, in the absence of the mayor, in an address interspersed with wit and humor. He repeated a remark of a lady that she had never seen such a jolly lot of men in all of her life, and added that he had never seen so many fat men in all of his life, and he conjectured that the cause might lie in some peculiar connection with electricity.

At the afternoon session, after the election of a number of new members, Mr. W. Worth Bean, of St. Joseph, Mich., read a paper on "The Advantages of Recording Wattmeters on Switchboards." Mr. Bean said that during the past three years, recording wattmeters had been used on the switchboard of the St. Joseph & Benton Harbor Street Railway & Light Company with excellent results. By their use the central-station manager is enabled to make contracts for fuel in an intelligent manner, since he will know the output of the station, thereby enabling him to intelligently test various kinds of coals offered. The wattmeter also enables efficiency of firing to be checked, and in connection with engine records a check is supplied on the efficiency of operation of the generating room. A further advantage that could be derived from wattmeters is the comparison of the results from different central stations for the purpose of learning if any savings in the operation of the plant are possible. Mr. Bean considers that the cost of switchboard meters is but a mere bagatelle, as compared with the cost of saving of coal that may result.

In reply to an inquiry, Mr. Bean said that every machine in his station is supplied with a switchboard wattmeter. Mr. F. A. Copeland, of La Crosse, said that the plant with which he is connected is supplied with output amperemeters, and that the discrepancy between their record and that of consumers' meters runs anywhere from 20 to 35 per cent, averaging about 27 per cent. Mr. Bean stated that on a recent Sunday 2000 more passengers than on a Sunday previous were handled, and with less difficulty, the reason being that as each car left the barn the second Sunday each motorman was notified to handle his car carefully, and in case of a circuit breaker opening, to start cars alternately. He said that as much steam could be produced from ordinary slack coal at $1.50 per ton as with lump coal. Mr. Ferguson said that while on the Chicago Edison system wattmeters were not used, owing to the regularity of the voltage, yet he could very readily see that in railway plants where the load fluctuates rapidly they would be exceedingly useful, and, in fact, necessary to get an accurate record of the load. As to the difference in the readings of station recording wattmeters and consumers' wattmeters, in the large Edison stations this is found to be from 18 to 20 per cent, while in alternating-current stations it may be as high as 50 per cent. In a direct-current station, 25 per cent should be considered a large figure. Inanswer to a question as to the cost of generating a kilowatt-hour of electrical energy, Mr. Grover stated that in his plant it was .8 cent. Mr. Copeland said that in his station the cost was about 1 cent per kilowatt-hour, using Youghiogheny lump coal and four condensing engines, one of which is a compound engine running only during peak load.

Mr. Wm. H. Edgar followed with a paper on "Wet Steam." Referring to foaming in boilers, Mr. Edgar said he considers that the cause is saponification due to soda contained in water, and he does not believe that it arises from the presence of mud or dirt in water; in nine cases out of ten, he considers that moisture in steam is due to saponification or the presence of soda. Where the steam is wet, he stated it is necessary to mix animal oil with the mineral cylinder oil, as the condensation washes off the mineral oil, while the animal oil clings to the walls of the cylinder. He considers that the great factor to be guarded against in water is the presence of soda. Where salt water is used, he said, there is often damage to the tubes and crown sheets from the salt. Oil returned to the boiler in the condensed exhaust is apt to cause trouble, making the tubes leak and buckling the crown sheet.

The first paper of the session of the morning of June 27, was that of Mr. L. E. Ferguson, on "Storage Batteries for Stations." In considering the question of the use of the storage battery, he said that account must be taken of the relative cost of the battery as compared with that of engines, boilers and dynamos providing for an equal capacity. The cost of capacity in the generating equipment is dependent solely upon the maximum power to be generated at any one time, and not upon the number of hours of use per day of the equipment; while in the case of a storage battery, the cost is dependent not only upon the maximum energy to be supplied at any one time, but also upon the length of time the power is required to do its maximum work. In other words, the cost in the first case is dependent upon the maximum kilowatt capacity, whereas in the second case it is dependent upon the kilowatt-hour capacity. In view of this, it follows that the character of the load curve is the determining factor.

For example, if the character of a curve is such that the average width of the peak is more than 1½ hours, then the initial cost of steam and electrical generating equipment will be less than that of the necessary storage-battery equipment at the present market prices. On the other hand, if the curve has a less average width of peak than 1½ hours, then the cost of the storage battery equipment will be less.

The cost of a storage battery of moderate size, say having a capacity of 500 amperes at a one-hour rate would be, at various rates of discharge, approximately as follows: 1 hour, $80 per kilowatt; 2 hours, $116 per kilowatt; 3 hours, $160 per kilowatt; 5 hours, $240 per kilowatt; 8 hours, $320 per kilowatt. These figures include switchboards, end cell switches and the battery erected complete, not including building investment.

The cost of a steam electrical generating plant will vary widely with the class of apparatus employed, but assuming $100 per kilowatt as a reasonable price for boilers, engines, steam generators, smoke pipe and switchboards, it follows that where the average width of the peak of the load to be taken care of is 1½ hours, the cost of installation is the same for the storage battery as for the steam plant.

The question of first cost, however, is not the only thing to be considered. The question of depreciation on the two classes of apparatus, economy of operation and the value of each class of apparatus as a reserve or guarantee to the customers of uniformity and reliability of service must also be taken into account. The principal battery companies guarantee to maintain some batteries sold by them up to the original standard of capacity and efficiency for a term of years, upon payment by the purchaser annually of a sum equal to a certain per cent of the original cost of the battery.

The operating expenses incident to the use of the storage battery are comparatively small. In very large and important installations it is desirable to have in charge a special man thoroughly experienced in the maintenance of a storage battery, but in moderate-sized stations it is unlikely that any additional labor would be required on account of the use of a battery, beyond that ordinarily employed in the station. The amount of material necessary is almost negligible. Distilled or filtered water is the principal item, and perhaps once or twice a year additional acid will be required.

A storage battery operated under favorable conditions should show upon test an energy efficiency of 75 per cent, and an ampere-hour efficiency of 90 per cent. The yearly energy efficiency of a storage battery operated under ordinary central-station conditions would, in all probability, not exceed 65 per cent.

As an illustration, the work done by a storage battery on a summer's day was given. This battery is kept floating on the system at all times during the 24 hours, and is charged between the hours of 12 o'clock midnight and 7 o'clock in the morning, at the time when the generating capacity in the station is only partially needed to provide for the current required by customers.

The curve of the station on an ordinary summer's day would have no decided peak, but in this instance a peak between 11 and 12 o'clock in the morning is assumed, due to a thunderstorm overclouding the city at that time. The load has come on very suddenly, perhaps so quickly that it would be difficult to get additional engines and generators on the system before a reduction in the pressure was effected by the sudden increase of load. The storage battery, however, being connected to the system, immediately takes up the demand and carries this peak until the storm is over.

On a winter's day, the battery is charged at the same hours as in summer, from 12 o'clock midnight until 7 o'clock in the morning, and discharged at a high rate during the time of peak, which comes between the hours of 4 and 6 o'clock in the afternoon. The battery discharges not only at the time of the maximum peak, but also for an hour or more after the peak has begun to fall, and this illustrates one advantage of the battery.

It very often happens in any system of distribution that feeders are of unequal length and carry unequal loads. The pressure, therefore,

which is maintained on the bus-bar of the station, is limited by the safe carrying capacity of the shortest feeders. When the short feeders are fully loaded, the long feeders will be overloaded, and if the bus-bar pressure is raised sufficient to load the long feeders, then the short feeders would be overloaded. To obviate this difficulty, the storage battery is exceedingly useful, and in determining the relative cost of storage battery and steam and electrical generating equipment, this important advantage of the storage battery must be considered, and reduced to its equivalent in money value and credited to its original cost.

In order that the battery may provide for the equal or economical loading of feeders, it is equipped with two or more end-cell switches, so that it may be operated at two or more potentials. The short feeders are then connected to the main bus and the long feeders to the auxiliary bus. One end-cell switch of the battery is connected to the main bus of the system and the other end-cell switch to the auxiliary bus. In this way the battery provides two potentials, one at perhaps 5 to 10 volts higher than the other, and during the time of peak of the load on the system the long feeders are operated from the auxiliary bus, the battery supplying all the current required by these long feeders and the pressure throughout the system maintained at equality.

Conditions may exist also in certain stations where it is desirable to give a twenty-four-hour service, and where the load is appreciable only during the time from dusk until midnight; and during the remaining sixteen hours of the day the load is so small that the cost of operating expenses for steam and electrical equipment would be so high as to make the use of the storage battery to take care of this long period of minimum load, a very desirable piece of apparatus. In this case, the generating plant would be started in time to fully charge the battery, so that it might take care of the station's load during the entire period of minimum load.

Mr. Ferguson said he considered that combination generators giving out direct and alternating currents from the same armature should find a very extended field, not only in large stations, but especially in small stations where sub-stations might be necessary for supplying certain outlying or distant districts. In such cases where the peak of the load in the districts supplied by the sub-stations comes at a different hour from that of the main station, the storage battery might be economically employed.

In this case, the storage battery would be installed in the sub-station, and the conversion apparatus in the sub-station would be shut down at the time of the peak in the district supplied by the main station, and the combination generator would be operated as a direct-current machine, the storage battery in the sub-station being discharged at a high rate for the period of time during which the maximum peak of the load remains in the district supplied by the main station.

As soon as the peak in the district supplied by the main station is over, the combination generators would then feed out alternating current in the sub-station, the conversion apparatus would take the load and the discharge of the battery would be cut down.

With such an arrangement it is possible with proper relative conditions of load between sub-station and main station, to use the same generating investment to carry the maximum load of both districts, and enjoy at the same time the other advantages which are gained by the use of a storage battery.

The advantages in the use of storage batteries, assuming that they have been determined by calculation to be economical for the conditions in which they are to be applied, are the guarantee of reliability of service which the central-station companies are able to give their customers, and the uniformity of pressure and freedom from fluctuations due to short circuits on the line.

The battery when charged is always ready for service, and should a sudden demand be made upon the station in case of accident to generators, engines or boilers, the battery is always prepared to take the load instantly up to the limit of its capacity.

The battery is exceedingly useful in small stations where the load on the station at certain times is very light, and where motors are supplied from the same system of mains. Under these conditions generators are extremely sensitive and do not maintain the pressure constant under the varying conditions of load, while the use of a storage battery keeps the pressure on the lines constant at all times, and variations which would otherwise come from short circuits and sudden variations in motor load, disappear absolutely under the influence of the battery.

The advantage of uniformity of pressure is especially desirable in small central stations where the cost of lamp renewals is an important feature, since by the use of the storage battery the life of the lamps is prolonged and the cost of lamp renewals thereby largely reduced.

In large central stations where the storage battery capacity forms a moderate proportion of the total output capacity, it should be used as a reserve to the boiler plant, being kept floating on the system continuously, and being used to keep the boilers working under economical load at all times, avoiding the necessity of keeping boilers banked or spare boilers under full pressure.

It is difficult to lay down a set of laws which might be used in the determination of the usefulness of a storage battery, for there are conconditions other than those of pure theoretical economy which must be considered, but it is probably safe to say that there is no economical advantage, although there may be sentimental advantages, in the use of a storage battery in a lighting system where the average width of the peak of the load is more than from one and one-half to two hours in width, although the battery may have a commercial advantage in insuring the customers of the central-station company a thoroughly reliable service with uniform quality of illumination.

In the discussion, Mr. Ferguson said that a storage battery has absolutely no place from an economical standpoint in a small station which has a long peak. The average length of the peak of the small lighting station is about 5 hours, and the cost of storage battery corresponding to this—$240 per kilowatt—is prohibitive, since the cost of the generating would be but $100 per kilowatt. Two years ago, when lead was cheaper, two hours was the time at which the cost of storage battery and generating plant coincided, but lead has gone up so much in price that the limit is lowered to 1½ hours. The depreciation of a storage battery will be guaranteed at 9 per cent, but in large stations guarantees are as low as 5, and in most cases, 6 per cent.

Prof. B. V. Swenson read a paper written by himself and Prof. A. W. Richter, on the subject of "Practical Testing of Small Lighting Plants," in which the result is given of a test of a combined lighting and pumping station. The plant has return tubular boilers, each of 43 horse-power capacity. The feed water is passed through an open-exhaust heater before entering the boilers. There is a 125-hp engine belted to a 90-kw, 220-volt Westinghouse alternator. The pump-house contains two duplex pumps, each having a capacity of 400,000 gallons in 24 hours.

The coal was weighed as it was brought into the boiler house, and the feed water pumped into two weighing tanks. Calorimeter tests at boilers and engines were taken every hour; all other boiler-room readings were taken at half-hour intervals. Indicator cards and switchboard readings were taken every ten minutes. In the pump-house all readings were taken at intervals of fifteen minutes. The steam pressure was 72.2 lbs., and the temperature of chimney gases was 407 degs. The temperature of the feed water was 136 degs. Indiana block coal was used, which was found to contain 11.5 per cent refuse. The evaporation was found to be 6.45 lbs. of fuel from and at 212 degs. F., or 7.32 lbs. of combustible. The evaporation was 1.61 lbs. per foot of heating surface. The test lasted 7.33 hours, and the average horse-power developed was 62.3, the maximum being 93.2. The dry steam consumed per indicated horse-power hour was 33.5 lbs., and the coal per indicated horse-power was 5.37 lbs. The friction of the engine was 8 per cent of the total load, and the average efficiency, or the ratio of the electrical horse-power to the indicated horse-power, was 53.2 per cent. The test showed that the boilers are operated at an average of but 70 per cent of their rated capacity, though during two hours of heaviest load they operate at 5 per cent above rated capacity. The flue gas analysis shows an average of 6.57 per cent of CO_2, which was pronounced too low. The steam pipe from the boilers to the engine was not covered, and it was determined that during the test 407 lbs. of steam, equal to 2.54 per cent of the total amount, was condensed between the boilers and engines. The result of this particular test showed that certain changes contemplated were not necessary, but indicated that other changes might be made which would greatly improve the economical efficiency of the plant.

Following the paper by Profs. Swenson and Richter, Mr. F. E. Hatch, president of the Hatch Electric Smelting Company, of Green Bay, Wis., addressed the convention on the subject of his patented electric smelter. He stated that his process consisted in roasting, burning or smelting by electric heating, and that he "multiplies the heat 42 times over what it is in the ordinary form of furnace." He said that in his smelter the heat is absorbed from three sections, whereas the current is only fed to one section, which, he stated, multiplies the heating effect by three. To heat 25 cubic feet 1000 degs. re-

quires, he said, 40 kilowatts; 1200 degs., 45 kilowatts; 1500 degs., 50 kilowatts; 2000 degs., 58 kilowatts; 3000 degs., 66 kilowatts; 3500 degs., 70 kilowatts. An ordinary blast furnace, he said, requires in treating iron two tons of coal for one ton of ore; in the electrical process but 350 lbs. of coal are required per ton of ore. As to the cost of the plant, that of a 100-ton blast furnace would be from $100,000 to $145,000, while his electric furnace would cost but $40,000. The furnace used revolves at the rate of half a revolution per minute, and is filled in the centre and tapped at the bottom. In treating bessemer ore, the furnace is closed airtight, and after the ore fluxes the slag is drawn off and the iron is left in the shape of a cast pig. If it is desired to puddle it into steel, this is done by simply increasing the temperature by 200 degrees and "having a rapid flow over the carbons at a higher temperature, which works the water out and puddles it into steel." The only furnace built is one for experimental purposes, and handles one ton per hour. Alternating current is used at a voltage of 10. The furnace is driven by a 1-hp motor.

On Thursday morning, after the transaction of some business, a paper by Prof. Shephardson, entitled "Why Some Municipal Plants Do Not Pay Better," was presented. A résumé is given of the present situation in regard to municipal ownership, including a fair statement of the arguments for and against municipal ownership. A list of municipal and private plants in Minnesota was given, which shows that in 1894 there were 10 of the former and 38 of the latter, while in 1900 these figures had grown to 53 and 63 respectively —a growth of 430 per cent for municipal and only 66 per cent for private plants; it is added, however, that these figures are not quite so significant as might at first appear, for many of the municipal plants are in towns so small as not to warrant putting in a private plant except in connection with some other line of business, and all the plants in the larger cities are privately owned.

A number of instances of mismanagement of municipal plants were given, showing that the efficiency of such plants is less than would be implied by the theories of some political economists. The illustrations point out the incompetency of those in charge of the plants, the poor systems of record, mistaken economy in design and operation, low rates, the dishonesty of aldermen and the baneful effects of politics. Prof. Shepardson said that the state of the records kept in some of the municipal plants is almost incredible, and instances were given where lights were used and no record found. In one instance, municipal authorities were beguiled into paying a higher price for a new lot of lamps, because that they had "more watts than the kind formerly used." In another instance, No. 6 wire was installed for a secondary circuit on the grounds of its carrying capacity as laid down in insurance rules; the drop was 22 volts on a 50-volt circuit, and the superintendent ascribed the unsatisfactory results to the kind of transformer used. In one town, the chief reason why one alderman voted in favor of a certain system against a lower bid, was that he preferred kilowatts, while the cheaper machine was a multipolar, which he did not consider as good as a kilowatt machine.

In concluding, Prof. Shepardson considered that arguments for and against municipal ownership must be modified by the personal equation. It is, he said, largely a question of circumstances. A community, whether a hamlet or a metropolis, is a co-operative institution, and should be run on business principles. Some manufacturing concerns find the best economy and the most satisfactory results in making all of their product from the raw material. Others, differently situated with respect to plant and market, or with respect to character and constitution of the officers, find it more satisfactory to sublet the contracts for the manufacture of parts, confining their attention principally to assembling and marketing. Each may be doing the best thing under the circumstances. In the same way, some communities may find municipal ownership to be more economical and satisfactory than private ownership. A much larger number than is generally supposed find it really better to purchase their lights from other parties.

Following Prof. Shepardson's paper, a paper was presented by Mr. H. H. Wait, on "Street Lighting." The following comparison was given as to the mean hemispherical candle-power of open and enclosed arcs, each consuming 450 watts. The watts per mean hemispherical candle-power of a direct-current arc is given at .8; of a direct-current enclosed arc with alabaster inner globe and reflector, 1.2; of an alternating-current arc with alabaster inner globe and reflector, 1.6. The following comparative figures for illumination at the street surface are given: For 450-watt arc lamps, 350 ft. apart, and incandescent lamps 150 ft. apart:

	Max.	Min.	Mean.
I. Open arc lamp	.94	.037	.124
II. Enclosed D. C. arc lamp, opalescent inner globe with reflector	.49	.037	.15
III. Enclosed A. C. arc lamp, opalescent inner globe with reflector	.44	.034	.14

For 450-watt lamps, 600 ft. apart and incandescent lamps 100 ft. apart, the following figures for intensity in candle-feet at street surface are given:

	Max.	Min.	Mean.
I. Open arc lamp	.93	.015	.13
II. Enclosed D. C. arc lamp, opalescent inner globe, reflector	.49	.18	.087
III. Enclosed A. C. arc lamp, opalescent inner globe, reflector	.31	.015	.061
IV. Incan. lamps, reflector, 1.5 watts net per m. h. s. c. p.	.21	.037	.11
V. Incan. lamps, reflector, 2.25 watts per m. h. s. c. p.	.14	.025	.073
VI. Incan. lamps at 3 watts per m. h. s. c. p.	.11	.018	.055

A consideration of these tables shows that at the higher values of street illumination such as are obtained with arc lamps 100 ft. apart, the minimum illumination is about the same for all four methods, and that there is no very great difference in the mean illumination, except that in the case of the open arc both mean and maximum are considerably higher, and the light for the alternating lamp is somewhat lower for the maximum, the mean and even the minimum.

At the low value of illumination, when the arc lamps are 600 ft. apart, the incandescent lamps appear more favorable with respect to minimum values. For example, the minimum value is nearly double that obtained from the open arc and the alternating arc, and considerably larger than from the direct-current enclosed arc. The maximum value from the incandescent lamp is much below the others, and the mean walue is lower than all the others except the alternating. This leads to the conclusion that on the basis of low minimum values low arc lamps cannot compete with incandescent lamps, and that it is only when considering the mean and maximum values that arc lamps show superiority.

Mr. Wait suggests that modern specifications should comprise the following items: 1. That the minimum illumination should not fall below a specified figure. 2. That the mean illumination shall not fall below a specified figure. 3. That the fluctuation of lamps should not give rise to a variation of more than 50 per cent from the specified average figures. 4. That arc lamps shall not be hung lower than a specified minimum of 18 ft., and that incandescent lamps shall not be hung lower than 10 ft.

After the transaction of some business, the meeting adjourned until June, 1901.

American Association for the Advancement of Science.

By William Henry Hale, Ph.D.

It is hard to write calmly the story of the last meeting of the nineteenth century of the American Association for the Advancement of Science, while yet the embers are smoldering of the most frightful holocaust in the history of this city—a lurid memento of the parting hour, such as never before marred the happiness of the enjoyable field-day which follows the arduous work of the meeting. For even while the members were returning from their various excursions, some to the Zoological Park, some to Cold Spring Harbor, some to West Point, the smoke of the conflagration was rising to heaven, and the miserable victims were perishing by hundreds in untimely death at the North German Lloyd docks.

The arrangements for the meeting were in some respects excellent. The University furnishes unrivaled facilities for the comfortable housing of numerous sections. But we missed the convenience and compactness of Columbus, where all sections could be accommodated under one roof, so that we could go from one to the other without delay; and the perfect system of telephoning from section to section every fresh paper as it was read, and bulletining the business of all sections on blackboards in each was greatly missed. The association had no funds to defray the expense, and the local executive committee would not attempt to enlist the services of such a man as Henry W. Maxwell, who, as treasurer of the committee of the Brooklyn meeting in 1894, pro-

vided several hundred dollars more than were required for the most liberal entertainment. Whatever of praise or of blame attaches to these arrangements, belongs wholly to the eleven men, mostly professors at Columbia, who constitute the local executive committee, or to the dominant majority of them. The alleged local committee, comprising all members residing within twenty-five miles of the City Hall, was not convened nor consulted about any arrangements, except the appointment of this local executive committee, at the initial and only meeting last October.

The new president, Dr. Charles Sedgwick Minot, of Boston, ranks eminent, probably pre-eminent among biologists. His address on "Certain Phenomena of Growing Old," as vice-president of Section Five, 1890, was a valuable contribution to biological literature.

At the opening session, President Seth Low, of the University, ably reviewed the progress of educational and scientific institutions of the city since the New York meeting in 1887, and even since the Brooklyn meeting in 1894. The aquarium, the botanic garden, the zoological park, numerous new laboratories, the new locations of Columbia and New York Universities, the great growth of the Museum of Natural History and other matters were mentioned.

President Woodward reviewed the development of science since the organization of the association in the middle of the century; the three greatest leaps having been the discovery of the law of conservation of energy and of the theory of evolution; and now the vast expansion of education.

Secretary of Agriculture James Wilson, having come on to preside at the meeting of the American Forestry Association, was called on for some remarks, and responded, urging the importance of applied science, especially in agricultural affairs. Whether or not Secretary Wilson's address fully compensated for the loss of Governor Roosevelt and Mayor Van Wyck from the programme, we certainly missed the very unique spectacle of seeing two such divergent political leaders addressing a scientific association from the same platform.

The selection of Denver as the place of meeting on Aug. 24, 1901, takes the association much further from home than ever before, Minneapolis, in 1883, having been the most remote point hitherto reached. That the Denver meeting will furnish points of unusual interest cannot be doubted, especially in the excursions that are sure to be arranged for many attractive localities, though a small attendance of members at this distance is inevitable. Even the present meeting had a registration below 450, which hardly exceeds the resident membership, including new members.

The physicists found comfortable lodgment on the ground floor of Fayerweather Hall, instead of being sent sykward up three flights of stairs, as the astronomers were. The union with the American Physical Society made a strong combination, and insured a large attendance for the four days in which papers were read, maintaining the interest till late on Friday, after all other sections, except the botanical, had adjourned. Prof. Ernest Merritt, vice-president for Section B, presided at section meetings, and Prof. Le Roy C. Cooley at those of the Physical Society, in the absence of President Henry A. Rowland.

Some beautiful photographs of the eclipse of May 28, taken at Wadesboro, N. C., by the Yerkes Observatory people with the 135-foot refractor, were exhibited to the section.

Prof. R. W. Wood illustrated his paper on photography of sound waves by very beautiful lantern slides, and T. B. Kinraide showed many fine photographs of electric phenomena.

Dr. N. E. Dorsey, on the polarization of the sun's corona, gave results of his observations at Pinehurst, N. C., where he was present with the party of the Naval Observatory.

"Besides visual observations, photographs of the corona were taken, together with its spectrum, through double-image prisms. This apparatus has the property of giving two images of an object looked at through it. One of these images contains light polarized in one direction only, and the other light polarized in a direction perpendicular to this. If the light from the object observed is unpolarized, these two images are alike. If polarized, they differ, and from the difference in these images the nature of the polarization is determined. In this way the light from the corona was shown to be polarized radially. The amount of this polarization was found by eye observations to increase as the distance from the sun increases."

C. T. Knipp illustrated the principle of the gyroscope by a bicycle wheel with long rod extending from the centre, supported on gymbals and balanced by lead pipe on the long end of the rod. When perfectly balanced, there was no motion, but on moving the lead pipe in either direction, the two motions, oscillation and precession, occurred, but in opposite directions, according to the position of the weight on one side or the other of the balancing position. When the weight predominated, the cusps were downward, and *vice versa*; also the direction of the precession changed.

Owing to the change in the constitution, Section D had no vice-presidential address. Vice-President John A. Brashear will deliver his address next year. Interest in this section is largely diverted to the meeting of the Society for the Promotion of Engineering Education, which met July 2, and but few papers were presented.

The report of the committee of the "American Section of the International Association for Testing Materials" on specifications for steel and wrought iron, was discussed at much length.

Discussion was also had as to the desirability of discontinuing the section, which had so little to do that it adjourned after two days' sessions.

Here follows a complete list of papers in this section: "Strength of Columns under Eccentric Load," by Thomas Gray. "Some Fundamental Propositions in the Theory of Elasticity," by Frank H. Cilley. "Frictional Losses in a Locomotive," by F. C. Wagner. "An Experimental Study of the Temperature Cycle of the Steam Engine and of the Cylinder Head," by Albert Barnes. "Specific Heat of Superheated Steam," by R. C. Carpenter. "Le Chatelier's Pyrometer, in which any error due to a variation in the resistance of the platinum and platinum-rhodium elements is eliminated," by D. S. Jacobus. "Engine Chronography," by B. F. Thomas. "Additional Note on the Theory of Half-Tone Printing," by Romyn Hitchcock. "Fly-Wheel Explosions," by Chas. H. Manning.

Section D met with Section I Wednesday afternoon to hear a paper by Edward Atkinson on "The Influence of Mechanical Invention on Social Conditions, with Special Reference to the Invention of Killing Instruments," in the course of which, as in three other papers read by him before Section I, he injected criticisms of the McKinley administration on its alleged imperialistic policy.

From the score of previous meetings of the association which the writer has attended, politics have been rigidly excluded; so much so that the sectional committee of Section I, with the active co-operation of the present "pro temporary" chairman of the section, as he repeatedly styled himself (whatever language "pro temporary" may be), refused to allow even to be read by title, though the council requested it, a paper on the government of New York City, which expressed no opinion either favorable or adverse to any politician or any political party, on the ground, among others, that it brought politics into the association. In one of Mr. Atkinson's papers this self-styled "pro temporary" chairman, though in the employ of the government, ruled that Mr. Atkinson was perfectly in order in stating that "the government was spending $150,000,000 to $200,000,000 a year in killing niggers in the Philippines."

The following officers were elected:

President—Charles Sedgwick Minot, Harvard Medical College, Cambridge. Vice-Presidents of the various sections of the General Council—Mathematics and Astronomy, James MacMahan, Cornell University, Ithaca; Physics, D. B. Brace, University of Nebraska, Lincoln; Chemistry, John H. Long, Northwestern University, Evanston, Ill.; Mechanical Science and Engineering, H. S. Jacoby, Cornell University, Ithaca; Geology and Geography, C. R. Van Hise, University of Wisconsin, Madison; Zoology, D. S. Jordan, Leland Stanford University, Stanford, Cal.; Botany, B. T. Galloway, Department of Agriculture, Washington; Anthropology, J. Walter Fewkes, Bureau of American Ethnology, Washington; Economic Science and Statistics, John Hyde, Department of Agriculture, Washington.

Permanent secretary, L. C. Howard, Department of Agriculture, Washington. General secretary, William Hallock, Columbia University. Secretary of the Council, D. T. MacDougall, Botanical Gardens, New York.

Secretaries of the Sections—Mathematics and Astronomy, H. C. Lord, Ohio State University, Columbus; Physics, J. O. Reed, State University of Michigan, Ann Arbor; Chemistry, W. McPherson, Ohio State University, Columbus; Mechanical Science and Engineering, W. H. Jacques, Massachusetts Institute of Technology, Boston; Geology and Geography, R. A. F. Penrose, Pierce, Ariz.; Zoology, H. B. Ward, University of Nebraska, Lincoln; Botany, A. S. Hitchcock, State Agricultural College, Manhattan, Kan.; Anthropology, G. G. McCurdy, Yale, New Haven; Economic Science and Statistics, C. A. Bennison (unattached), Cambridge, Mass. Treasurer, R. S. Woodward, Columbia University.

Electrical Calcutta.

BY R. W. ASHCROFT.

ELECTRICAL Calcutta is still in embryo; indeed, for that matter, so is electrical India. But, slowly and surely, the disciple of Mahomet, or of one of the numerous Hindoo dieties, as the case may be—the coolie whose duty it is to pull the punkah o' nights, or to see that the cocoanut-oil lamp is properly trimmed, or to take messages with somewhat more rapidity than an A. D. T. boy displays—slowly but surely this individual is working out his own condemnation by his infernal stupidity and laziness, and electrical appliances are taking his place.

The electric desk fan and the electric ceiling fan have sealed the fate of the punkah; its oscillations are becoming feebler and feebler, and will soon entirely cease. And when one considers that four punkah pullers are included in the bag and baggage of every white man in India, transient or otherwise, the Indian labor question assumes a very complex position in view of the introduction of our Western methods of breeze-manufacturing. Every electric fan imported into India means depriving four natives of their means of subsistence; and it seems as though our electric fan manufacturers, who are trading here should annually devote a goodly portion of their profits to that annually-recurring institution—the Indian famine. It is not at all strange that Mahomet and Brahma should nowadays be having their slumbers constantly interrupted by the pitiful supplications of erstwhile punkah pullers for the destruction of this new-fangled enemy of theirs—electric fans and electricity. If there ever is another Black Hole of Calcutta, any fan manufacturer who happens to be in town at the time will undoubtedly find himself an inmate, if his identity is known.

For a punkah breeze, the established price is 12 annas per 24 hours. This sum, which is equivalent to 24 American cents, is divided among four coolies, so that each gets the munificent salary of 6 American cents per day—and some of them support a family on this. The Calcutta Electric Supply Corporation, a somewhat recently-established institution, is now supplying power at the rate of 4 annas per kw-hour. The punkah coolies work in two shifts, from six to six. The day shift does quite reliable work, if a vehement injunction, such as "Tanno," meaning "Pull," is given them every five minutes. The night gang, however, are familiar with "ways that are dark and tricks that are vain." Their duty is to pull the punkah over your bed, and thus save your anatomy from being perforated by mosquitoes and other vermin without end; but they are sadly handicapped in the performance of their duty by their unceasing attempts to get as near to 12 hours' sleep as possible during the interval between 6 p. m. and 6 a. m. Thus it is that, in India, a boot-jack is used nocturnally to create activity rather than to suppress it; and, even if your aim is good, the punkah coolie will be off to sleep again in the next 15 minutes. So, is it not reasonable to suppose that the Calcutta Electric Supply Corporation will pay handsome dividends, at least from that department of its service appertaining to supplying power for electric fans?

The Calcutta Electric Supply Corporation is, so I am told by a gentleman connected with it, the first enterprise of its kind in India. It is an English company, capitalized at £100,000. Mr. F. R. Reeves, Mansion House Buildings, London, E. C., is secretary, and Kilburie & Company, Calcutta, are managing agents. Practically all of the material that has been used so far in the construction of the plant, and in the equipment of the service, is of English manufacture. Boilers of Babcock & Wilcox manufacture are virtually the only exception. However, the plant can hardly be said to be half complete yet, and there is, therefore, ample opportunity for American manufacturers to endeavor to supply some of the material.

Electric power is being manufactured at present by this company in three different sections of Calcutta, but one plant only is of importance. One of the two small plants is located in Howrah, which is the town opposite Calcutta across the River Hooghly, and this plant confines its work to lighting a few arc lamps in the railway yards thereabouts. A similar plant is the other small one, which provides power for another batch of arc lamps along Harrison Road, in the native quarter. This, however, is an experiment in street lighting which is undoubtedly the forerunner of a complete installation of arc lamps throughout the streets of Calcutta.

The main plant is located within easy distance of the European quarter of the city, and is now feeding in the neighborhood of five thousand 16-cp incandescent lamps in offices, residences, stores, churches, public buildings, etc., and at the same time is running the motors of about one thousand ceiling and desk fans in like institutions. The distribution is on the three-wire, 500-volt system, the lamps being of 220—220 volts. There are two 85-ampere and two 250-ampere machines, and two balancers, made by Crompton Company, Chelmsford, England. Willans engines are used. No street lighting has yet been attempted by this plant, nor will it be for some time, owing to the opposition of certain old gentlemen, with more or less power in the administration of the municipal government, who are financially interested in the manufacture of what they call the illuminating gas of Calcutta, but which surely is a misnomer, as, even with a Welsbach attachment, I cannot get more than a couple of candle-powers out of my burner.

Overhead bare copper wire is used by the Calcutta Electric Supply Corporation, and many have been the accidents that have happened therefrom, even thus early in its operation. The violent tropical storms that so frequently visit the city always give the repair department plenty to keep them busy, and seriously discommode the purchasers of the current, who need it for their fans 24 hours out of 24, as can readily be surmised when you picture a temperature of 90 degs. and a humidity of about 90 per cent.

Calcutta boasts of several lines of street railway, all operated by the Calcutta Tramways Company, but this company relies on horse-flesh for most of its motive power. It has one line—the longest of its system—to which it has applied steam as a motive power. This is the branch from the Esplanade to Kidderpore, about three miles in length. The cars are disreputable in appearance, and are used only by the natives—the Europeans preferring to patronize the gharries, or cabs, which can be had at the equivalent of 24 American cents per hour, or one dollar per day of nine hours.

There is also a poorly-patronized and poorly-operated telephone system in the city, about which I found it impossible to get any information other than that the affair justly merits the two compound adjectives that I have above applied to it. While messengers are cheap, it would seem that a telephone service properly furnished would be much cheaper and would be well patronized in a country where even the physical exertion of writing a letter is gladly avoided.

The International Tramways and Light Railways Exhibition.

The International Tramways and Light Railways Exhibition, which is being held at the Royal Agricultural Hall, Islington, N., from June 23 to July 24, was successfully opened on June 22, by Mr. W. H. Dickinson, Esq., chairman of the London County Council. A large number of influential gentlemen were invited to meet Mr. Dickinson at the inaugural services, and gathered in the Agricultural Hall about noon. The greatest credit is due to the association, to its secretary, Mr. A. M. Willcox, and to Mr. Courtenay, as well as to the exhibitors themselves, for the extremely forward condition of the exhibits when the exhibition was declared open. It has been the writer's privilege on a great many occasions to see exhibitions of various characters in different parts of the United States, but he has never seen an exhibition opened in such an advanced state of preparation as the Tramways and Light Railways Exhibition just opened in London. Mr. Dickinson did not make very extended remarks in opening the exhibition, another opportunity being afforded for speeches at the inaugural luncheon, which was served to about 300 guests at 1 o'clock. The toast of "The Tramway and Light Railway Enterprise" was given by Mr. Dickinson, and was replied to by Alderman W. E. Clegg, of Sheffield, and Mr. J. B. Concannon, of London. In proposing the toast, Mr. Dickinson made the interesting statement that in the year 1899 no fewer than 871 million of people in London traveled by tram or bus; that is, every man, woman and child took a trip once in two days. The toast of "Municipal Authorities" was proposed by the Right Hon. James Bryce, M. P., who is evidently a strong believer in the municipal control of tramways, and was replied to by J. W. Benn, Esq., chairman of the Highways Committee of the London County Council, and Sir Samuel Johnson, town clerk of Nottingham. This toast necessarily brought up some discussion on the subject of whether it was best for tramways in cities to be controlled by municipal authority or by private enterprise. The "Board of Trade and Light Railways Commission" was proposed by Sir William H. Preece, K. C. B., and was replied to by Henry A. Steward, while the "Engineering Profession" was proposed by John H. Stafford,

Esq., and was replied to by Prof. J. Perry, president of the Institute of Electrical Engineers. After luncheon, the gentlemen scattered through the hall and made a careful inspection of the numerous interesting exhibits, which, by the way, are extremely handsome. It is impossible at this time to give a description of all the exhibits, but it will suffice at this juncture to say that the companies who are interested in the development of tramways in Great Britain have most assuredly come forward in a very satisfactory way and have enabled the Tramways and Light Railways Association to make an exhibition of which every one may be justly proud. During the continuance of the exhibition, meetings of the association are to be held, and it is expected that on these occasions short papers will be read by Messrs. John Young, C. H. Gadsby and Phillip Dawson.

The Paris Exposition Third-Rail Road.

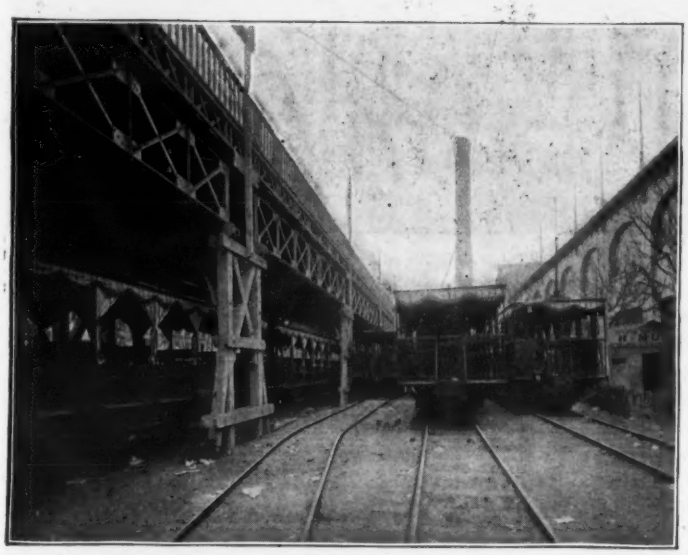
Owing to the novelty of the moving sidewalk, the great bulk of the travel within the Paris Exposition grounds is done by that means; but the third-rail road being cheaper comes in for a very good share of patronage, and to the average visitor is also quite as unfamiliar though not altogether so sensational. It has already been explained in these columns that the road touches in a circle all that part of the Exposition which lies on the left bank of the Seine, including the Champ de Mars, the Esplanade des Invalides and the Quai d'Orsay. It is an endless circular track, in the same sense as the sidewalk, but has sidings for reserve rolling stock along the Avenue de la Bourdonnais side of the Champ de Mars. The maps for the road and the sidewalk are virtually the same, although the stations are differently placed, there being five for the road and nine for the walk; those for the former being on the ground level, while those for the walk are all in the air, like those of the New York Elevated. At the Alma Bridge, the road runs into a cutting, while along the Avenue de la Motte Picquet on the other hand, it is carried on a separate elevated structure, 20 ft. above the ground, on the level of the walk. As has already been explained, to facilitate travel, the walk moves contrarily to the direction of the hands of a clock; the road runs as the hands do. The total circuit is about two and one-half miles, and the worst grade is about 4 per cent on a short stretch. The curves are very easy, the least radius being 120 ft.

The road is laid with rail of the Vignole type, weighing 50 lbs. to the yard, and is single track, with a gauge of 3 ft. 3 ins. The third rail is raised several inches from the ground on porcelain insulators fixed at the extremities of the sleepers, and is the same as the track. It is heavily bonded with copper plates, copper-riveted; and the track, the two rails of which serve as return, is also well bonded with copper conductor. The power rail is on the inner side of the circle, *i. e.*, the side furthest away from the station platforms. Around the sidings, a bent-bow trolley is used with overhead wire, to lessen any possible danger to the workmen. Out in the open, at work, the motor cars have these trolleys held down by their cord.

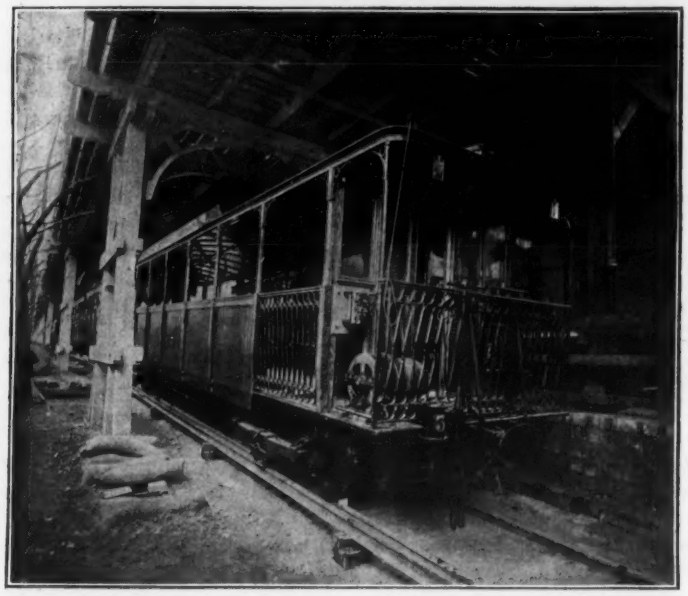
The trains on this road are composed of a motor car and two trailers. The motor cars are also passenger, and are about 39 ft. long, equipped each with four Westinghouse 30-hp motors, as well as with hand-brakes and air-brakes, the compressor being motor-driven. The

THIRD-RAIL ROAD IN FRONT OF TRANSFORMER STATION.

VIEW NEAR AGRICULTURAL BUILDING, SHOWING THIRD-RAIL ROAD AND MOVING SIDEWALK.



CARS AT TERMINUS OF THIRD-RAIL ROAD.



MOTOR CAR, THIRD-RAIL ROAD.

usual Westinghouse controllers are carried, and the cars are lit electrically with flat-bulb incandescents. Each motor car will accommodate 82 people, with 46 sitting. The trailers are about 35 ft. long, and will carry 62 people, 32 sitting. A full train will thus carry 206 passengers. The road is provided with 9 motor cars and 18 trailers, thus making 9 trains of 3 cars each. The speed of the road at rush hours is from 10 to 12 miles an hour, including stops, and the trains run on a headway of one and one-half minutes at those periods. This gives

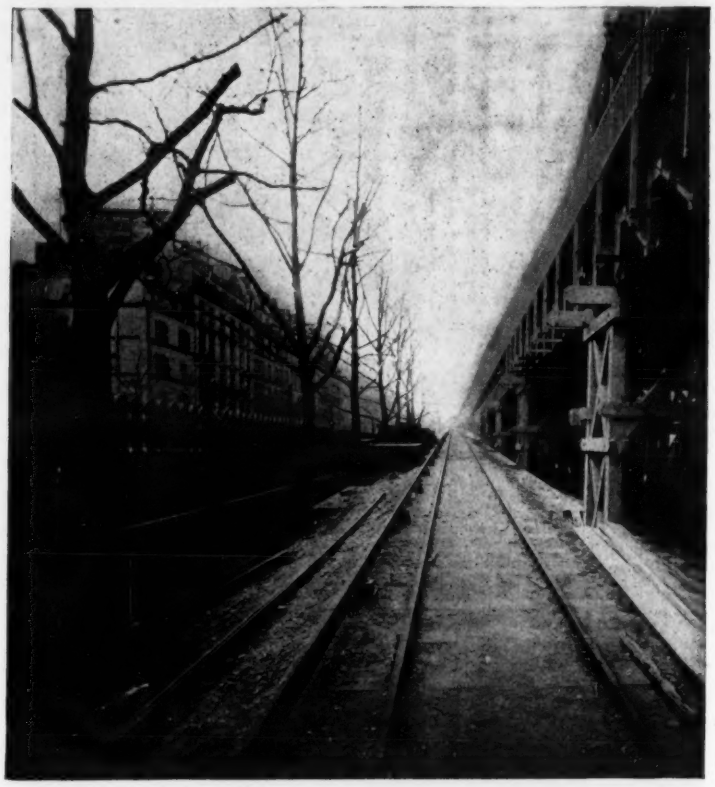
A STATION OF THE ROAD.

the road a carrying capacity of about 10,000 an hour at such times. The service at all seasons is good, and the public appears to be well satisfied with it. The cars are open, but have side curtains as a protection against sun and rain. Some of the benches are arranged sidewise and some across.

Current for the road is supplied from the handsome transformer station at the corner of the Quai d'Orsay and the Champ de Mars, which also furnishes current to the moving sidewalk, both transportation systems being under one control, that of the Compagnié des Transports Electriques de l'Exposition. This station, fed from an outside Westinghouse railway power plant, was referred to in these pages last week. It should be visited by all engineers attending the Exposition. It is just in the rear of the Military and Marine buildings, and immediately behind the huge one of the Schneider Armor Works. A feature that is quite novel and striking in its way is the incorporation of three fine trees into the building. They could not be cut down, so there they stand in front of the marble switchboard, and between the duplicate operating plants, and some of their branches have already burst into leaf under the ceiling. Three-phase current at 5000 volts is received here, and the road has been run by an 8-pole, 650-kw Westinghouse generator, direct driven by a big induction Westinghouse motor of 850 horse-power—said to be the largest ever built, and taking the 5000 volts direct; the generator supplying current to the road at 550 volts and running at 290 r. p. m.; the weight of each machine being not less than 29 tons. The road has also been furnished with current from a Westinghouse, 650-kw rotary transformer, receiving its prime current at 360 volts through statics at the rear of the switchboard, and delivering current at 550 volts to the line. Each end of the station, at each side of the switchboard, has one large induction-motor set and one of the railway generators, while there are also two smaller motor-generator sets used as combination starting apparatus and exciter for each large unit. The preliminary work of running trial trains was done with one of the exciter sets installed then, taking 60 horse-power, although the set is rated at but 40 horse-power. The static transformers are also in duplicate, and as there are two sources of exterior current supply, brought in by underground cables in separate leads, it will be seen that every possible precaution has been taken against interruption. The apparatus at either end of the station is in itself adequate to the demands made by the two transportation systems. The regular source of current supply for the plant is the very large Westinghouse power plant of the Compagniè Generale de Traction at Issy-les-Moulineaux, now in process of enlargement on an extensive scale for important permanent work. The 5000 volts from the line is taken by the induction motor, three-phase, without any stepping-down, and that motor drives direct the 650-kw generator feeding current to the sidewalk motors. But, as stated already, the third-rail road unit can and does also get its current through the statics.

The five stations for passengers along the line are quite pretty and even pretentious, and they have been located so as to be of best service in reaching objective points. They are Electricity Building; Eiffel Tower, Military and Marine buildings, the Street of Nations, and the Invalides. The cars are closed by grating, etc., on the inner side, so that passengers cannot fall out or, if curious, get at the third rail; and the mounting and dismounting of the passengers at each station is supervised by an army of uniformed attendants, all of whom have apparently been instructed to act on the supposition that the travelers know nothing and are utterly unable to take care of themselves.

The fare for the ride is only 5 cents, and the ride is as long as the passenger chooses to make it while the cars continue to circulate. The fare is collected at turnstiles, which register, and the passenger hands over small brass discs which he purchases at the entrance of each station, no money being taken at the turnstiles. The "exits" are at either end of the platforms. The road is really in operation about 14 hours a day, although the public patronage does not fully cover that period; but it starts in at 9 a. m. and runs till 11 p. m. On holidays it has run trains under a schedule of one per minute, and during



GRADE ON THE THIRD-RAIL ROAD.

the after-part of such days the cars have been crowded to their fullest capacity. In smoothness and steadiness of operation, the road could not be surpassed. On any holiday the use of the road is so great as to necessitate the full employment of all its rolling stock, and trams are loaded to their utmost capacity. In wet weather also, when the sidewalk is not desirable on account of being exposed, the sheltered third-rail road gets the bulk of the travel. At all times it is popular and useful.

Each motor car is provided with two sliding contacts for picking up the current, both, of course, on the inner side of the car, as shown in the accompanying illustration. The contact pieces are pressed down on the rail to insure good conductivity, and the "skates," as the French call them, are knuckle-jointed, so that they can be reversed in their angle of inclination to the rail should it be necessary to reverse the car.

The engineer of the Compagniè des Transports de l'Exposition is M. Armand Cahen, and the Exposition power plant is in charge of Mr. J. T. Wolfe, to both of whom we are indebted for courtesies in the preparation of the above data.

U. S. Electrical Section, Electricity Building, Paris Exposition.

THE Paris Exposition, so far as arrangement goes, is wonderfully well planned, but it may be questioned whether the carrying out of that plan could be much worse. It has been said that the Vienna Exposition in the early seventies was the most beautiful, and the hardest to form a true, consecutive idea of, that Europe had ever seen; but Paris in 1900 certainly takes from it that dubious compliment. Possibly the fine art sections are complete as they stand, but since some of the finest art treasures are in the various national headquarters, or even in some of the other sections, the art exhibit of no nation can be studied in its totality in one spot. When it comes to a careful study of anything in the line of mechanics or engineering, the state of things can only be described as confusion worse confounded, for while the classification is good, the plan of location and arrangement has utterly broken down. All this may be said without in reality

ONE END OF THE ELECTRICAL COLLECTIVE EXHIBIT.

embodying a single word of censure or criticism on the Exposition authorities, who, when they came to divide up the exhibits, found that the space at their disposal for any specific group or class was not large enough by two or three times. This was better than having an Exposition without exhibits, but it led to a fierce struggle among nations and sections for every foot, and, as is now well known, one result in regard to the foreign exhibits in machinery, agricultural tools, bicycles, automobiles, etc., was that they had to go to Vincennes; so that the visitor interested in any such section has had to inspect at least two widely-separated shows, at the cost of at least two entrance fees instead of one, with all the consequent waste of time and money. For exhibitors, the situation has been even more serious, because it necessitated, in a great many cases, two exhibits instead of one; two spaces, two sets of attendants, and two sets of expenses, while the attendance at Vincennes is only about one-tenth what it is at the main Exposition in the heart of Paris.

While the United States machinery exhibit has thus been split in two, that of electrical apparatus has been kept together in one building, but even in that building its two divisions, ground floor and gallery, are so widely separated, one would hardly know they belonged to each other. When one surveys the scene and all the conditions, admiration grows of the work done by Director Drake and his gallant little staff, with wonder that they ever succeeded in getting things together. The general plan of Electricity Building on the Champ de Mars is easily understood. It crosses at right angles the other two large containing Palaces, and has the lovely Chateau d'Eau as its portico, or entrance, from the long esplanade. The French and foreign service plants for light and power occupy the extremities on the ground floor. Then in the middle comes a large gallery floor which unites the galleries around the sides of the power plant wings. Under the gallery floor are grouped the heavier exhibits of the various foreign countries, and, in spite of whatever lighting may be done, that area will remain dark and gloomy, to say nothing of being quite unhealthy with draughts and the dampness of the earth lying just under the bare boards, as well as other features which need not here be particularized for decency's sake. On the gallery floor above range the lighter exhibits, not only of foreign countries, but of France, and including the several Courts of Honor erected by France, Switzerland, Germany, the United States, etc. But, unfortunately, there is very little coincidence between the sections below and those above, if of the same nationality. For instance, the United States ground floor section touches the French power plant, but its Court of Honor and its gallery section are hundreds of feet away overlooking the foreign power plant. To have reversed affairs in the gallery, so as to bring the United States Court of Honor and the gallery exhibits at the other end of the gallery floor would seem easy and obvious, to a superficial observer; but there were doubtless serious reasons why this could not be done, the main one being, as already intimated, the pressure for space. In Group 5, Electricity, the number of "exposants" is far beyond what was expected. The total is nearly 1100, according to the classes, and in the mechanical classes, whose figures are not yet available, the numbers are even more in excess of estimates. In Electricity groups, Class 23, production and mechanical utilization of electricity, there are 291 exhibitors all told, of whom France has 83 and the United States 102. In Class 24, electro-chemistry, there are 141, of whom France has 84 and the U. S. A. 17. In Class 25, electric lighting, there are 241, of whom France has 99 and the U. S. A. 75. In Class 26, telegraphy and telephony, there are 210, of whom France has 73 and the U. S. A. 59. In Class 27, miscellaneous applications of electricity, there are 170, of whom France has 74 and the U. S. A. 32. In other words, out of a total of 1053, France has 413 and the United States 385, leaving only 255 for all the other countries combined. This is a really splendid showing for the United States, and does much to offset the absence of large generators and engines bearing distinctive American names.

In these pages last week an account was given of the opening of the United States electrical sections in Electricity Building, and a description was furnished also of the Court of Honor. It is now proposed to pass in rapid review the commercial and industrial features of the exhibit, reserving, however, for ampler treatment a few of the larger exhibits which at this time of writing were not quite ready; such, for example, as those of the General Electric and Western Electric Companies. Between their two ground floor spaces ran a regular railroad track which stood open and in service for weeks after the show began, with hundreds of passing trucks, out of which packages were thrown pellmell into mounds of dirt and refuse. It is obvious that to expose delicate models costing thousands of dollars to the frequent chance of accident thus invited, or to attempt to wire up and

ONE END OF THE GALLERY COLLECTIVE EXHIBIT.

operate fine telephone switchboards in the dust, damp and disturbance, was neither prudent nor desirable; so that such exhibits and others had to await the quieting down of the building in general before serious work could be attempted.

The vista of the several hundred feet of gallery space occupied by the United States is very pretty and attractive. Being a "collective exhibit," the United States authorities have been able to give it a harmonious setting. The whole space is enclosed from the wide aisle that overlooks the foreign power plant by a long, low, iron railing of special design, finished in deep brown and bronze, and is distinguished further by its row of lofty arc lamp posts, as shown in the views herewith, each post carrying two lamps, and the bracket being the curved body of an American eagle which holds a lamp in its beak. For this work, the C. J. Toerring Company, of Philadelphia, furnished to the

United States Commission 40 of their enclosed arcs, which have a very graceful and effective appearance. At the beginning of the long row, the Ward Leonard Electric Company has a large separate space devoted to its well-known resistances, rheostats, dimmers and various specialties of the same general character, designed for the European market or made to foreign order. The next space is occupied by the Gold electric car heater, which is shown in parts and assembled and as applied to the street car, the office, etc. The next space is occupied by the Helios-Upton Company, and has a surprisingly complete display of their enclosed arc lamps, etc., with examples of inner and outer globes, fixtures, brackets, and other essentials of the system as used in America and Europe. In this space is shown also a neat display sample board of the Hart & Hegeman switches, the whole being in charge of Mr. Rosenberg, on behalf of H. M. Salmony, the London agent for the two American firms. The next space is that reserved for the American Institute of Electrical Engineers and other engineering societies meeting at the Exposition, and it is adjoined by that of the McGraw Publishing Company, illustrative of technical journalism, and exhibiting not only periodical publications, but over fifty books issued from the presses of the concern. The space beyond is that of the Worthington Pump Company, and is used for office purposes only, their main exhibit being, of course, the superb 40,000,000-gallon pumping plant of the Exposition, situated on the banks of the Seine near the Trocadero. Next comes the Rowland multiplex telegraph based on alternating current, and exchanging messages eight at a time, at the rate of 350 words each per minute, with a corresponding station in the American space on the ground floor.

After this range of individual spaces, one comes to the cases of collective exhibits, but the whole space is made uniform and continuous, not only by its railing and lamps, but by the handsome backboard draped in heavy green baize the entire length, and reaching up to the windows. There are nine very large and handsome oak cases built specially in America for the exhibit and set some edgewise to the aisle and some full face, with plenty of room for walking around them. Just within the rail are placed a number of objects too large or too heavy for casing, while the whole of the backboard along the rear wall is occupied by special panels and groups of articles sent in that form by the exhibitors. At the end of this section, next to the individual spaces, is conspicuous the bank of their universal interlocking theatre dimmers sent by the Iron Clad Resistance Company, who display also their standard field rheostats in different sizes and types; a reversing crane motor controller with renewable contact switch, and their special heavy duty resistances. At the other extremity of the collective exhibit is placed a big magnet for removing splinters of iron and steel from the eye, as described and illustrated in the ELECTRICAL WORLD AND ENGINEER some weeks ago before its shipment to Paris. It weighs complete about 600 lbs., and will support some 12 ozs. through a thickness of wood, one-fifth of an inch interposed, or more than 3 ozs. through half an inch. The tilting magnet can be swung in any direction. This ingenious novelty, made by Mr. E. B. Meyrowitz, has perhaps attracted more popular attention than any other piece in the collection. The intervening space along the front of the collective exhibit is occupied by a variety of apparatus, including a single-phase motor from the Wagner Electric Manufacturing Company; some transformers from the Pittsburg Transformer Company, and a motor and flexible shaft of the Stow Manufacturing Company, the motor being one-half horse-power multiple speed, and the apparatus being intended for portable drilling, tapping and reaming. The same concern shows also a centre grinder. There is also a Yankee twist drill grinder combined with the system of Wiley electrically-driven tools, shown by James Clark, Jr., & Company, of Louisville, Ky.; and an equipment for electrical indication, etc., from the Johnson Electric Service Company; these being supplemented by a few machine tools of different makes.

The display along the backboard is very effective, and consists chiefly of groups on panels, although there are several displays in which the material or apparatus has been made the basis for an artistic design in itself. The Vulcanized Fibre Company, of Wilmington, Del., have a neat board displaying their fibre in its various forms for all purposes of electrical insulation and general mechanical purposes. Huebel & Manger, of Brooklyn, show their bells, etc.; Partrick, Carter & Wilkins, of Philadelphia, have a neat, compact display of bells, signals, annunciators, burglar-alarm springs, pony pushes and other house and hotel goods, with which their name has so long been connected. M. I. Vought & Co., La Crosse, Wis., show in practical use their ball drops for lamp suspension, etc. Pass & Seymour, of Syracuse, have some of their porcelain specialties, but their work is best set forth in the United States Government pavilion, for which they supplied all the porcelain receptacles used in the lighting and decoration. Crouse-Hinds Electric Company, of Syracuse, in similar manner, has one of its fine panel boards, but the bulk of its "exhibit," as it should rightly be called, is to be found in the United States pavilion, or in the United States section of the Palace of Diversified Industries, for which it supplied all the panel boards, distribution boards and knife switches. The Chase-Shawmut Company, of Boston, has an excellent sample board bearing its name, upon which are grouped in neat arrangement their fuse wire, fuse links and types of Cartwright enclosed fuses, etc. The Holmes Fibre-Graphite Company, of Philadelphia, has a neat little display board of its specialties nearby, and Albert & J. M. Anderson Manufacturing Company, of Boston, represented by Robert W. Blackwell Company, of London, has a large board of knife switches and a sample board of line material. The Sprague Electric Company, of New York, has an interesting exhibit of its latest types of conduit mounted on a handsome board, which is studied with much attention by European engineers, who are amazed to learn how universal the practice has become in America of running wires in this way. In fact, the comments of Americans on the exposed wiring at the Exposition and the burial of the heavier wires in bare earth throughout, promise to change these conditions, and to bring about in Europe a far greater use of conduit for all classes of work. The Adams-Bagnall Company have a compact display of their enclosed arcs, and Mr. C. J. Toerring also has one supplementary to the aisle lighting already mentioned. The General Equipment Company, of Camden, N. J., illustrates on the wall its well-known magnetic cut-out, and not far off the Belknap Motor Company, of Portland, Me., has one of its automatic voltage regulators. The Wagoner & Williams Hardware Company, of Cleveland, Ohio, has a collection of its copper segments, and special iron and steel drop forgings; while the Eureka Tempered Copper Works, of North East, Pa., makes an interesting display of its products in the material giving its name to the concern. Another category of apparatus is illustrated on the wall by the complete working exhibit, with storage battery, of the Herzog teleseme; and by the "elechrometer" clock of the Sempire Clock Company, of St. Louis. One is very much disappointed at the almost entire absence of fan-motor exhibits, that being a branch of American industry that could be pushed to advantage in Europe; and only the Warren Electric & Specialty Company appears here, one of its fan motors being shown. The obvious explanation is that many American makes of fan motors are alredy handled here in Europe. The Falcon Electric Manufacturing Company, of New York, has, for example, on exhibition at Paris some 20 of its fan motors, but they were all furnished to an English firm. The General Incandescent Arc Light Company has also supplied fan motors for the Exposition. Two kindred exhibits on the wall that attract much notice are the handsome I. P. Frink reflector—a sample only, however, of others installed elsewhere by the government—and the beautiful display of the Holophane Glass Company, which has bunched together in a pretty manner a number of its holophane globes and shades, which are also to be seen, by the way, in use on the service lamps of the United States exhibits. The Safety Insulated Wire & Cable Company, of New York, stands out as representatives of its line of industry, with a fine, big mahogany board, in which are grouped in four rows its leading types of wire and cable under the headings of army, navy, power and intelligence. The carbon industry, which is also illustrated elsewhere in the collective exhibit, is brought to notice on the back wall by the displays of the United States Carbon Company, of Cleveland, Ohio, which shows some very heavy carbons, and that of the National Carbon Company. The United States Company has a complete line of carbons used as anodes in electrolysis, die made and very dense. The shapes range from ¼ x 1 x 4 ins. to 3½ x 8 x 24 ins. Another of its lines exhibited consists of standard size carbons for electro-metallurgical work, ranging from ⅜ in. and 18 ins. long, for aluminum work, up to 9 ins. diameter by 30 ins. long, used in the production of carbide. There is also shown a very full set of arc light carbons, solid and cored, for all classes of work. The National Carbon Company, of Cleveland, has made a fine display, and has filled two large boards with as many examples as they could carry of its innumerable products in the carbon line for lamps, batteries, furnaces, brushes, telephones, etc., giving an impressive idea of the vital importance of the material in all branches of electrical industry. The Crown Woven Wire Brush Company has a board, showing its products, and the Trimont Manufacturing Company, of Roxbury, Mass., has grouped together a choice lot of its tools.

Most of the telephone exhibits have been grouped together on the wall, although a few have been put in the cases. It would, perhaps, have been better if none had been put inside glass, because there are difficulties enough under any circumstances for the student in making a comprehensive survey of apparatus in any class. As compared with anything to be seen in Europe, this apparatus shows up remarkably well, and is of quite distinctive type. The Farr Telephone & Construction Supply Company, of Chicago, shows its high-grade exchange telephone complete, with long-distance transmitter and receiver. The

EXHIBIT OF RHEOSTATS, ETC.

Standard Telephone & Electric Company, of Madison, Wis., also exhibits a complete telephone set, as do the Pennsylvania Electric Company, of Marietta, Pa.; the Stromberg-Carlson Manufacturing Company, of Chicago, and the Western Telephone Construction Company; the Telephone Manufacturing Company, of Sumter, S. C., and the Viaduct Manufacturing Company, of Baltimore, which has a portable set. The names of other American telephone exhibitors were given in the full lists printed recently in these pages, but at the time of writing this article their apparatus had not been placed on view in the space.

It will have been seen already how large and varied is this "collective exhibit," but the half has not been told, for there are all the nine big, upright, two-sided show cases, brimming over with standard and representative products in a most miscellaneous range of American electrical and mechanical industries. The chief items in the cases are necessarily the smaller samples and items, and have been changed about somewhat from time to time to accommodate new and late arrivals. A good display is made of instruments, including those of the Weston Electrical Instrument Company, the Wagner Company, American Electric Specialty Company, Queen & Company, Norton Electrical Instrument Company, Marshall condensers and the Deshler-McAllister portable photometer of the Electric Motor & Equipment Company, etc. Foote, Pierson & Company, of New York, show some of their latest telegraph instruments, a sample of their ink-writing registers, a portable combination fire-alarm telephone set, the Lewis automatic cut-out for storage battery, some fuse protectors and "Argus" lightning arresters. The Bristol Company, of Waterbury, Conn., shows its recording instruments for pressure, temperature and electric current, and has furnished a special recording pressure gauge and recording voltmeter for use on the switchboard of the United States Machinery Hall at Vincennes. The McCay Engineering Company, of Baltimore, has sent a complete line of its goods, including a 24-lb. tailor iron, a 6-lb. laundry iron, an electric stove and two wall heaters. The American Electrical Heater Company, of Detroit, has also sent an exhibit of soldering irons, and the American Electric Heating Corporation, of Boston, and the Hadaway Electric Heating & Engineering Company, of New York, are also represented by their well-known products in this field of current utilization. The goods of the United Electric Heating Company, of Detroit, are exhibited elsewhere in the Exposition, by the Compagnie Generale Electrique de Nancy. Primary batteries are conspicuously illustrated in the cases by the product of the Leclanché Battery Company and the Gordon Battery Company; while the official list for the electro-chemical group includes also the Gould storage battery, the miniature storage battery of the United States Battery Company, the dry batteries of William Roche, the Voltamp Company, the Non-Polarizing Dry Battery Company, and the New Excelsior Dry Battery Company. Other "wet" batteries are the "Samson" of the Electric Gas Lighting Company of Boston, the Federal Battery Company, and the Manhattan Electrical Supply Company. Among battery novelties may be mentioned the cigar lighter of the Abbott Electric & Manufacturing Company, of Cleveland, and the induction coil of E. S. Ritchie & Sons, of Brookline, Mass., for Röntgen-ray work. Among wires and cables are those of the Eastern Cable Company, and the Montauk Multiphase Cable Company for fire-alarm purposes. The exhibit in one of the cases, of the Chicago Fuse Wire & Manufacturing Company, consists of an assortment of fuse wires and strip put up in the usual packages, and of links put up in boxes with glass covers so as to display the goods in an effective manner. The Kester Electric Manufacturing Company also shows samples of its flux for electrical work. The Hardy Lamp Company, of Pittsfield, Mass., exhibits samples of its candelabra, miniature and decorative lamps, street, series and 220-volt lamps; also its standard 3, 3½ and 4-watt multiple and street railway lamps. The New York & Ohio Company, of Warren, Ohio, also has in the collective exhibit some of its lamps and one of its transformers, and has furnished, as already noted in these articles, a good many special lamps for the national pavilion and the work of the United States commission generally; while other lamps are in the exhibit of Robert W. Blackwell & Company, who represent so many American firms in France. Speaking of lamps reminds one also of the lamp renewers, etc., exhibited here by the Incandescent Electric Light Manipulator Company, of Boston, which shows various styles of its ingenious device for getting at high sockets. The Lakon Company has in the collective exhibit one of its transformers, and the Partridge Carbon Company also makes a display of its goods in one of the cases.

Supplementary to the strictly electrical lines are several allied in one way or another, and in some of them the exhibits are quite

TYPES OF COLLECTIVE EXHIBITS.

fine. This is true of mica and micanite, as shown by the Mica Insulator Company, of New York, in one of the cases. The collection of mica is unique and embraces many specimens gathered carefully during the last 40 years. The New Process Raw Hide Company shows a few specimens of its pinions, and the Peerless Rubber Company makes an exhibit of its Rainbow sheet packing and packing for piston and valve rods, etc. The cases also show prominently the specialties of the Standard Paint Company, in P. & B. compounds, etc.; the Geometric Drill Company, of Westville, Conn.; the Oster Manufacturing Company, Cleveland; the Acheson Carborundum Company, the Vitrified Wheel Company, the chucks of the Oneida Manufacturing Company, saws of the Goodell-Pratt Company, of Greenfield, Mass.; C. D. Mosher's steam separator, the goods of the New York Belting & Packing Company, Advance Packing & Supply Company, New York; Anti-Friction Metal, Silverine Babbitt metal, Watson injectors, Bristol steel-belt lacings, Kennedy valves, Ambler asbestos air-cell covering, Schaeffer & Budenberg gauges, etc. In very few instances are the above exhibits different from the goods as

familiarly known and used in America, and taken thus collectively they create a very favorable impression in the mind of the foreigner, and have led to frequent inquiries or reference to the set of trade catalogues kept for that purpose in the adjacent space of the ELECTRICAL WORLD AND ENGINEER. It remains to be seen how the various juries will regard the exhibits and make awards on them when they come up for consideration in their respective classes. It should be here noted that complete lists of the electrical exhibits proper from the United States were given in the article appearing in this journal June 16, to which reference should be made for many items not now referred to in detail.

The American ground floor space of Electricity Building is very largely occupied by mechanical, rather than electrical, exhibits, as will be seen by consulting the plan published June 16. (See E. W. and E., p. 901.) It has already been noted that heavy American electrical apparatus is conspicuous by its absence, and is to be looked for in the foreign sections, where it is shown by manufacturers working under American licenses, or in such conspicuous work as the Westinghouse moving sidewalk, third-rail road and transformer power plant, which have been discussed in separate articles. American electric motors, while well in evidence in Electricity Building, are also to be seen to even better advantage in the United States Machinery Hall at Vincennes, or in such places as the United States Publishers' Building on the Esplanade des Invalides (see E. W. and E., June 30, p. 975). The Bullock Electric Manufacturing Company and the Lorain Steel Company have both of them fine exhibits of their motors, etc., in the centre of the American space, but neither was quite ready when these notes were taken, and fuller reference is therefore deferred. The General Electric Company, whose types of apparatus are now built by allied concerns all over Europe, has contented itself with filling a large space with a very large model of its three factories at Lynn, Schenectady and Harrison. This is set in the centre of the space under a canopy, and is lit from below and above with incandescent lamps, giving a brilliant effect. Part of the space is filled with large photographs on easels, and part is occupied by luxurious furniture for the use of visitors. The company has, however, while not exhibiting any of its thousands of products, supplied the United States authorities with considerable material of one kind and another. The Western Electric Company has a most elaborate exhibit in a space of about 2500 square feet, but its completion was greatly delayed both by the slow delivery of goods and by the incompleteness of the building, railroad tracks and dirt paths being open all around it for weeks after the show was officially declared to be ready. The United States ground floor section is marked off from the other foreign sections adjoining by its special uniform iron rail and its lamp supports, each of which carries two Western Electric enclosed arcs, there being 48 of these, two in series, on 220 volts direct current. There are also about 30 lamps in the Western Electric space, running on 110 volts direct current. The exhibit includes also other types of Western Electric arcs, such as the Petite, for alternating-current work. Within the space is set up a 75-kw generator, direct current, 110 volts, direct driven by a 112-hp motor, both on the same base. The current from this unit is used for electric lighting. In regard to this branch of work, the company shows also, for series work, the armature of one of its 125 lighters. Its multi-current line of machinery is shown by drawings, etc., in a group of eight large pictures, and its direct-connected units are also shown in this way, in arc lighting and power sizes. The exhibit of actual machinery includes, however, six motors of various powers, enclosed and open. In the line of telephone work, there are two twin motor generators for battery charging, two ringing dynamotors, batteries, etc., and there are complete separate power boards for the telephone system and for the electric lighting. To illustrate the telephone industry, the company has equipped a complete Bell "common-battery" exchange with 100 stations and a small toll station; and the exchange has been placed at the service of exhibitors and the United States Commission for internal and external communication. Beyond this, there is a set of Western Electric fire-alarm apparatus in operation and a variety of telegraph and testing apparatus in show cases; while a separate case is devoted to street railway supplies. At one side of the space are shown in handsome models the company's New York and Chicago factories, made in plaster and painted faithfully after the originals, the New York model being 3 feet by 4 feet and the Chicago 4 feet by 9 feet. Taken in its entirety, the exhibit is at once comprehensive and creditable. It so happens that the fine exhibit of G. Aboilard & Co., the French branch of the Western Electric Company, occupies a large space right above in the gallery. It is devoted chiefly to telephone apparatus and cables, in which an enormous business is done, requiring the output of one of the largest factories in Paris.

Just across a narrow aisle from this exhibit, the Edison Manufacturing Company occupies a large space, devoted to its batteries, fan motors, phonographs and some other Edison specialties. The space is handsomely draped in green plush, etc., having on one side a large showcase above staging and in the rear a huge pile of material and supplies treated decoratively. This space is a great centre of attraction at all times, on account of the frequent phonograph recitals given there. Immediately in its rear is the fine exhibit of Tinius Olsen & Co., of Philadelphia, comprising a complete laboratory for the testing of all kinds of material, such as iron, steel, wood, paper, oil, etc., the machines shown being able to apply tensile, compression, transverse, impact, torsion, viscosity, friction and lubrication tests. One of the machines shown records automatically any stretch within the

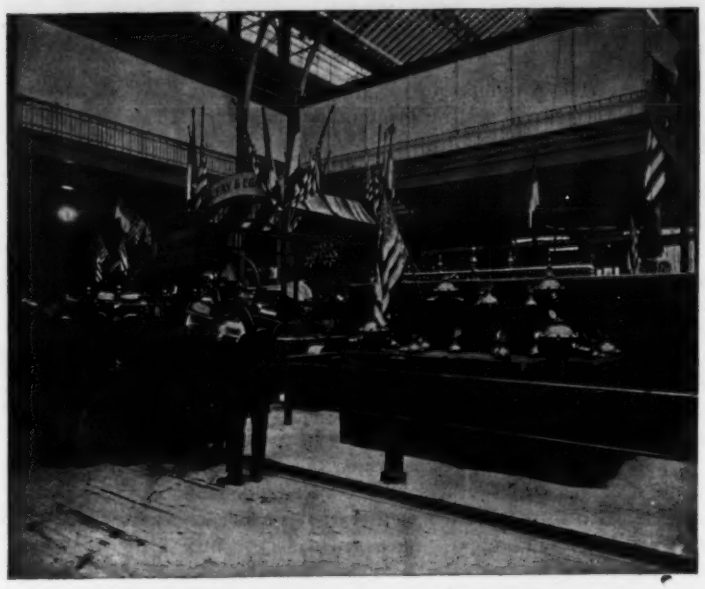
A QUIET CORNER.

elastic limit and magnifies it 500 times on an indicator card. Another feature is an automatic cement tester arranged to give results directly on applying power. The exhibit is operated by a 3-hp Gramme motor.

Across the aisle again from the Olsen exhibit is another of equally interesting character, namely, that of the Batcheller Pneumatic Tube Company, which has a circular run of several hundred feet of large tube fastened under the ceiling, to illustrate the operation of its system for carrying heavy packages and mail matter. This exhibit is operated by a Commercial motor of 15 horse-power. It may be here observed that while many of the exhibits in this section are of a mechanical nature, the use of electric power to drive them makes them of special interest to those who are still unacquainted with the manner in which electric power is now so freely applied in the United States. Most of these motors are American built, but not all, so that a further opportunity is afforded to contrast their methods of construction and the results of operation. Thus the Rockwell, Clough exhibit has a 2-hp Bonillet motor; W. P. Healy, 5-hp French motor, without nameplate; Morgan Machine Company, 3-hp Patin motor; W. S. Doig & Co., ½-hp; Bement-Niles-Pond Company, 10-hp General Electric motor; Gisholt Lathe Company, one 2-hp and one 5-hp Northern motor; Norton Emery Wheel Company, ½-hp General Electric motor; Fay, Egan Company, 22-hp of Triumph motors; E. W. Bliss Company, 15-hp Nancy General Electrique Cie; Gleason Tool Company, 2-hp Crocker-Wheeler; Gould & Eberhardt, 2-hp Sprague-Lundell; Robins Conveying Belt Company, 5-hp Sprague-Lundell; Ferracute Machine Company, one 2-hp and one 3½-hp Triumph and one 5-hp Crocker-Wheeler; Chicago Pneumatic Tool Company, one 7-hp Milwaukee motor. The Triumph Company has also a joint exhibit of its motors with the Le Blond Machine Tool Company. It will be seen that we have here a very respectable power transmission plant, and as some of the tools are direct-driven, some are belted and some are hitched to motor line shafting, a very neat illustration is given of electric motor practice in the present year of the Republic and at the end of the century. The Ferracute Machine Company alone has in its space three driving systems, one punch press having an individual motor, two other sets in pair with two pulleys on the motor, and the remainder of the exhibit is driven by line shafting. Nor is this all,

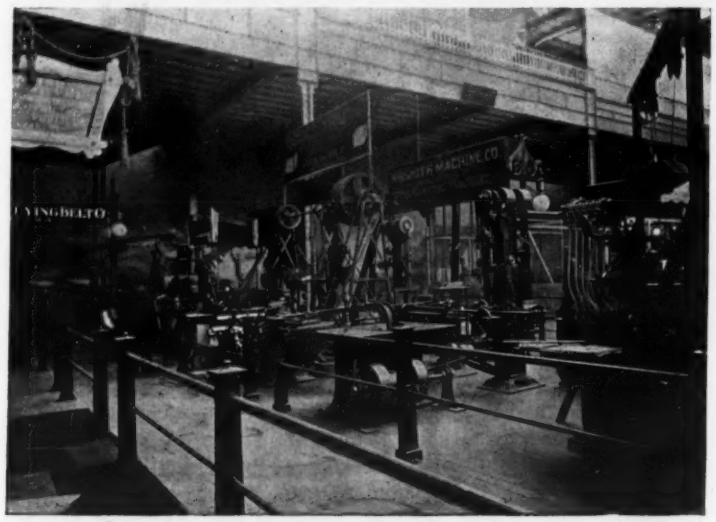
for in the centre of the space is a large revolving album, 7 feet high, showing 200 different photographs of presses, the leaves being turned automatically by a figure of Uncle Sam, while a phonograph, also automatically operated, tells the astonished spectators all they need to know about the machinery, in English, German and French!

In close juxtaposition at one side of the United States section are



WATCHING ELECTRICALLY-DRIVEN MACHINERY.

the leather belting exhibit of Chas. A. Schieren & Co. and the wire exhibit of John A. Roebling's Sons Company, thus illustrating the two mediums of power transmission in sharp contrast, but very amicably. The exhibit here of wire comprises all the Roebling manufactures in trolley, weatherproof, magnet, electric light and power, and telephony, as to conductors; while there is also a fine display of power and telephone cables and lead-encased cables of all kinds. There is also a section of electric railway track to exemplify the method of connecting up underground cables with the slot trolley system of circuits. Over in the Mining and Metallurgical section or building there is another Roebling exhibit devoted to wire rope more particularly. It consists of a number of reels of wire rope and two cabinets of wire and rope, surmounted by a model of the New York and Brooklyn Bridge worked out in fine detail. The same exhibit



A MAIN AISLE ON GROUND FLOOR.

contains also a centre board displaying various samples of rope and fittings. In the same section, by the way, the electrical visitor has to look for the exhibit of the American Steel & Wire Company, occupying a large part of the space allotted to the United States. This exhibit consists of everything manufactured or mined by the company from the iron ore, zinc and copper, through every process of manufacture to the finished product. In the electrical line is made a fine display of "Crown" rail bonds, copper wire, trolley wire, insulated, armored and lead-encased cables of every kind for interior, aerial, underground and submarine work. The handsome arrangement of the exhibit, and particularly the display of large cases in the gallery, make it very prominent and effective.

Returning to Electricity Building, the exhibit of the Stilwell-Bierce & Smith-Vaile Company will be noted as one of the leading mechanical and electrical features there. It consists of a combined vacuum pump and jet condenser, a vertical marine feed pump, and an electric triplex pump, vertical type, direct connected. The combined vacuum pump and jet condenser of the single-cylinder type, has a capacity of about 7000 lbs. of steam per hour. It has been utilized by the United States Commission for condensing purposes, in connection chiefly with the adjacent exhibit of the Ingersoll-Sargeant Drill Company, and it is therefore seen to advantage in actual service. The pump has its latest improved tappet motion with outside valve adjustment. It is also equipped with an improved vacuum breaker and a condensing chamber of special design, provided with a distributing valve for straining the water. All valve decks are located above the cylinder, and the design of the pump is such as to obviate all air pockets. It is also equipped with a valve motion which insures full stroke, and there is a brass-lined cylinder which is entirely removable. The triplex pump is of its latest-improved, vertical style, 4-standard type, each crank being provided with two bearings and two supports. The four-standard feature is patented, and its intention is to distribute the strains on the crank shaft. Many advantages are said to be secured. The crank shaft is of the three-throw type, each crank being set at an angular advance of 120 degs. The plungers are single-acting, outside

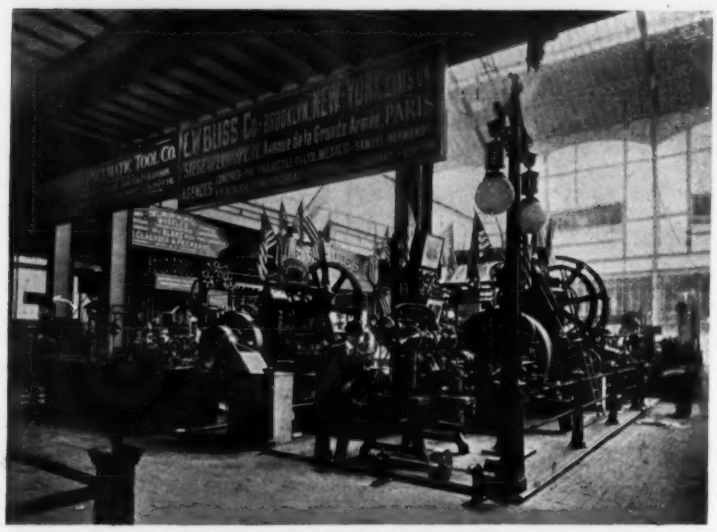
COMPRESSED AIR AND ELECTRICITY COMBINED.

packed and guided, reciprocating through deep stuffing boxes. The crosshead is of the locomotive type, operating in adjustable bronze shoes. The connecting rods are of the strap end form, with bronze journals at the crank shaft connections, with taper key adjustment. The gears are machine cut and the pinions of bronze and shrouded, double reduction being used to allow of direct connection to the motor, which is carried on an extension base. The feed pump shown, of the vertical marine type, is designed for heavy boiler work, up to 300 lbs. per square inch, and allows of quick access to all working parts.

The Ingersoll-Sargeant Drill Company is exhibiting in no fewer than four places, but has a fine display right at the heart of the United States section of the Electricity Building, where it has in operation one of its "Class H" compressors. This supplies compressed air to all the pneumatic tool exhibitors around and to a vertical steam engine which has been installed for the purpose of driving a dynamo to give extra light in the gloomier recesses of the section, overshadowed almost everywhere by the galleries. This compressor, which is the largest engine in the United States space, has two steam cylinders 12 in. in diameter with a 12 in. stroke, taking steam from the service mains. There are two air cylinders, a low pressure of 18 in. diameter and a high of 12 in. Air is taken into the large cylinder first, at about 30 lbs. compression, then passes through a cooler in the base of the machine, where it is cooled to the temperature of running water. Then it goes on to the high-pressure cylinder, where it is again com-

pressed at from 95 to 105 lbs., after which it is received by a reservoir and piped thence to the machines it operates. Another interesting Ingersoll-Sergeant exhibit is to be found in the Civil Engineering and Transportation Building, where a number of working models, one-eighth size, of its drills, are run by a small compressor of its Class E type, which, operated in turn by a General Electric motor, furnishes 28 cubic feet of air at 50 lbs. pressure when run at 150 r. p. m. Not only are the models set thus in motion, but a Payne engine and another steam engine are also put in operation by it, and a curious illustration is given of the cycle of power and the inter-relations of distinct classes of machinery.

One of the largest of the electrically driven exhibits is that of E. W. Bliss Company, as noted above. Its main features are an automatic can-body forming and lock-seaming machine, which receives large sheets of the proper size and discharges finished cans at the rate of 60 per minute, only one operator being required; a No. 1 toggle-drawing press for making seamless drawn articles of sheet metal, receiving the metal and drawing it into shape, besides cutting it also if necessary; a No. 6 lathe with anti-friction burnisher, arranged for spinning out the wrinkles produced in drawing steel shapes and for necking and shaping such articles as water pitchers, coffee pots, bottles, rice boilers, cuspidors, etc.; and a No. 3, three-quarter, bottom slide drawing press for making seamless articles from the flat sheet of tin, copper, brass, etc. It has a weight of 30,000 lbs. Large numbers of Bliss machines are already in use in Europe, and these awaken the deepest interest in all who see them. There is another large Bliss exhibit in the United States machinery



METAL STAMPING, DRAWING, ETC., BY ELECTRICITY.

hall at Vincennes, and a great many of other Bliss machines are shown on the Champ de Mars in the spaces of Messrs. G. Drouet, G. Ellison and H. Lemaire.

Of apparatus in the valve class, there are excellent displays made by the Ashton Valve Company and the Chapman Valve Company. A neat display is made by the Crane Company of brass and iron valves and fittings, screwed and flanged, for wrought iron pipe and for all pressures of steam, gas or water, together with fitters' tools and engine trimmings. The Walworth Manufacturing Company has also an extremely handsome ebony and plate glass case near the main service switchboard, containing a fine exhibit of its bronze seat gate valves, joints, pipe bending, etc. The Lunkenheimer Company, of Cincinnati, also has an excellent exhibit, with two attendants, consisting of a large variety of engineering appliances suitable for steam, water, gas, oil, air, etc., and including valves, lubricators, whistles, safety valves, injectors, oil cups, etc. In the line of water-power apparatus, there is not much to be seen of American origin, but the Pelton Water Wheel Company, through Sloan & Company, its Paris agents,, has an exhibit of one of its standard size water motors, and shows also in connection with the Rand Drill Company a Pelton water wheel direct connected to a Rand air compressor.

It will be gathered from the above casual notes that a creditable exhibit is made in both electrical and mechanical apparatus in the United States sections of Electricity Building, subject to the limitation that so much of the fine American machinery is at Vincennes, as shown in the list and diagram printed June 16 in these pages, and in the illustrated article which appeared on June 5 on the opening of the Vincennes Building. While an impressive effect is thus lost, and while a likely customer has no small trouble and fatigue inflicted on him in inspecting the apparatus under such conditions, it is gratifying to know that excellent sales and inquiries are reported on every side.

PARIS EXPOSITION NOTES.

VINCENNES.—A number of the smaller American pavilions at Vincennes were inaugurated by Commissioner-General Peck on Friday, June 15.

THE SUPPLY OF CURRENT.—One evening during the third week of June, at about 9 o'clock, the electric lights suddenly went out in the part of the Exposition around the Trocadero. Something in the generating station had gotten out of order, and it took the workmen over an hour to repair the damage to such an extent that current could be turned on the circuit again. The occurrence was very annoying to the numerous visitors, but much more so to those having concessions in those parts of the grounds. The next evening the same thing recurred, at about the same hour. There is some talk of having the city withdraw the franchise of the company furnishing this district with electricity, if it does not give any better service.

AN AMERICAN LOCOMOTIVE formed the subject of an interpellation in the Chamber of Deputies last week. The locomotive in question is on exhibition in the French section of the transportation department at Vincennes. The opposition asked the government the reason of showing foreign manufactures in the French sections. The Minister responding for the government said that it was impossibe to make such locomotives in France; that he was an engineer, and was able to judge such questions. This reply must have had a bad effect, for a little later on the same gentleman added that all the French works were overburdened with orders, and that they could not fill them. For this reason it had been necessary to have some locomotives built elsewhere. The locomotive forms part of the rolling stock of a State railroad, and was exhibited as such.

THE INTERNATIONAL AUTOMOBILE RACE for the possession of the cup donated by Mr. Gordon Bennett, took place last Thursday. June 14. Five participants started: Three Frenchmen, one Belgian and one American. Only two of the contestants, both French, arrived, the others being put *hors de combat* by accidents to their machines. Owing to the long course of the race (350 miles), no electric vehicles took part.

A CONTEST OF ELECTRIC VEHICLES, organized by the journal *Sport-Universel Illustré*, was to have taken place on Monday, June 18. Two days before this date the prefect of the department Seine-et-Oise with drew the authorization to run through his territory, giving as a reason for his action the fact that the contestants in the Gordon Bennett race had run at excessive speeds in passing through villages under his care.

Nernst Lamp Patents.

Among the patents issued June 26 are twenty-six assigned to the Westinghouse Company, and relating to details of the Nernst lamp system. Six of these were issued to Ethan I. Dodds, and relate to switches for Nernst lamp circuits. One patent was issued to Walther Nernst and Henry Noel Potter, of Göttingen, Germany, the subject being a heater cut-out device for electric lamps. Five patents were issued to Henry Noel Potter, of Göttingen, Germany, all relating to the heaters and the heater circuit of Nernst lamps. One patent on a heater was issued to Edward Bennett, and four to Marshall W. Hanks, relating to details of construction of the Nernst lamp. Seven of the patents were in the name of Alexander Jay Wurts, and relate to a multiple-glower lamp, igniting systems, a circuit breaker, details of the lamp and fixture means for heating high-voltage glowers, and system distribution, all relating to the Nernst lamp. Two other patents were issued to A. J. Wurts and Marshall W. Hanks, one on a detail of the Nernst lamp and another on heater-tube support for the same. Another patent of the same date was issued to Charles A. Terry, having for its object to produce an electrolytic lamp having a long life.

The applications for all of the six Dodds patents were filed Sept. 9, 1899, two being renewed in May, 1900. The first in order of issue is on an automatic switch adapted to close a Nernst lamp circuit, and then, by its own operation, to open the heater circuit at the end of a

predetermined time. When a push button is shoved in, both the heater and glower circuits are closed; the heater wire is wound around a bulb containing mercury, and as the mercury is gradually heated, it rises until a circuit is finally closed which actuates an electromagnet, which then releases a switch and breaks the heater circuit. The second patent is also on an automatic switch for the same purpose as the first one; when the glower circuit permits a predetermined amount of current to pass, an electromagnetic trip releases a switch which breaks the heater circuit. The third patent is on a snap switch for Nernst lamp circuits. In operating the switch ,the handle is first turned to a given position, at which position both the heater and glower circuits are closed. After the glower has become a good conductor, the switch-arm is carried to an intermediate position, thereby breaking the heater circuit, and to turn out the light the switch handle is turned to the left; all of the various operations, by means of spring actions, are suddenly performed. The fourth patent is on an automatic push button switch for Nernst lamps. There are two buttons, one of which is pushed down until the glower is brought to a conductive temperature, and when released the heater circuit is cut out, but the glower circuit left in operation; the latter circuit may be broken by pushing a second button. The fifth patent is on a knife switch which has two contacts; when the blade is pressed down both heater and glower circuits are closed, but when the hand pressure is released, a spring shoves up the blade so as to release it from the heater contact, thus throwing the heater circuit out. The final Dodds patent is on a cut-out device for heater circuits adapted to operate with a quick and sudden movement, so as to prevent sparking when the heater circuit is interrupted; in this case the temperature of a pot of mercury is raised by the heater-wire and the consequent expansion finally results in making a contact, thus causing the heater circuit to be quickly broken by a switch mechanism.

The Bennett patent is on an electric heater for the Nernst lamp. A tube is molded from talcum, or other suitable insulating refractory material, and subsequently baked. A heater-wire is then wound about the tube as a helical coil and its ends attached to terminal wires fixed in each end of the tube before it was baked. The heater is then provided with a coating of non-conducting refractory material of sufficient thickness to cover and imbed the heater-wire. The principal object of the patent is to provide for efficient terminal wires.

The first of the four Hanks patents in order of issue number, has for its object to provide Nernst glowers with terminals having the most intimate connection possible with the glowers themselves, and at the same time capable of being readily joined to the connecting wires. The ends of the glower are highly heated, as by oxyhydrogen flame or an electric arc, and a small quantity of platinum melted against the heated end; the end with the platinum attached is then subjected to a very high temperature as, for instance, by an electric arc, when the small body of platinum embeds itself in the end of the glower and forms a good electrical as well as a firm mechanical union therewith. The leading-in wires are then readily attached to the glower by causing the embedded conductor to be melted and plunging the ends of the wires into the melted globule. The second Hanks patent relates to a plan for utilizing, when breaking the heater-circuit of a coil, a solenoid having as many strands as there are glowers, each strand also serving as a part or the whole of the steadying resistance for the glower with which it is connected. As illustrated, there is a multiple lamp consisting of three glowers, and an electromagnet with three windings is connected with each glower. By means of the electromagnet, the heater-circuit may be automatically broken when it shall have accomplished its purpose of bringing the glowers to a sufficiently high temperature for the reception of the normal current. The third patent relates to means for making connections between the ends of the glowers and the leading-in wires. To the ends of the glowers are applied beads or enlargements of chalk-like porous materials, which are subjected to the action of an oxyhydrogen flame for a sufficient length of time to thoroughly bake the material. The leading-in wires are then fused upon these beads by means of some conducting alloy such as copper-platinum, etc. A good mixture for the beads may be formed by mixing kaolin with water. The final Hanks patent is on a means for supporting the glowers and other necessary parts of the Nernst apparatus, and for making conveniently detachable circuit connections therewith. Among the details, a glower supporter is described which enables a glower to be replaced by merely loosening four coupling ends.

The patent issued to Walther Nernst and Henry Noel Potter is on a heater cut-out device. The inventors have found that the thermostatic devices hitherto employed for breaking the heater circuit are very slow in returning to their first position, by reason of the fact that the enclosed device and chamber in which they are enclosed, require considerable time to cool down to such a temperature as will permit the thermostat to re-establish the heater circuit. The object of the device patented is to avoid the effects of slow cooling and to render it possible to relight the lamp almost immediately after having extinguished it. The thermostat is installed in connection with the steadying resistance employed with the Nernst lamp. When the current flowing in the glower approaches normal, it heats up the steadying resistance, which in turn heats the strips of the thermostat, causing them to break the heater contact. One of the two strips of the thermostat is so located that when the lamp circuit is opened it cools more rapidly than the other strip, and contact of the heater circuit is therefore established before the strips become entirely cold. The lamp may thus be again set in operation by turning on the lamp circuit but a short time after it has been turned off. The device may also be placed within a closed case containing a body of inert gas.

Of the five patents granted to Henry Noel Potter, the first in number has for its object to organize the parts of the Nernst lamp so that there shall be only a slight difference in potential between any portion of the glower and the adjacent portion of the heater; and also to form the heater so that it shall be of light weight and at the same time capable of imparting the heat to the glower in an efficient manner. The heater-wire is wound on a U-shaped grooved tube made of baked talc. After the wire is wound in the grooves of the tube it is covered by a paste of the same material as that employed for making the body of the tube, this protecting the conductor and holding it in position. The second patent is on a controlling system for Nernst lamp heaters, consisting in the employing of magnetic or thermostatic means included in shunt circuit to the heater. The heater is of the U-shaped form just described. By means of the solenoid, upon starting the heater is brough tinto proximity with the glower, where it remains until the latter becomes conductive; at this point the circuit of the heater is broken and at the same time that of the solenoid, when the action of a spring withdraws the heater from proximity with the glower. The third Potter patent is on a stationary heater for a Nernst lamp, consisting of a spiral conductor wound upon a thread or rod of non-conducting material in a manner analogous to that of certain wire-wound strings used with musical stringed instruments. One form shown is a straight spiral, inside of which is the glower; and in another form a glower in the shape of an arc is shown within a similarly-shaped spiral heater. The fourth Potter patent is on a means for breaking the circuit of the heater when its further conductivity is unnecessary. The cut-out has a self-actuating coil in series with both the heater and glower circuits. The winding of the coil is such that the armature is not moved by the passage of the current of the heater alone, but will be actuated when the sum of the heater and glower currents reaches a certain amount. The final Potter patent is on an electric furnace for use in making Nernst lamp glowers. It consists of a tube composed of a mixture of dry electrolytes, such as magnesia and yttria, in such proportions as are usually employed in Nernst lamp glowers. About this tube is pressed, before baking, a paste of one of the constituents of the tube, such as pure magnesia or pure yttria. This jacketed tube is then baked into one solid piece by submitting it to intense heat. The composite tube thus prepared is heated in any suitable manner to such temperature that one tube becomes an electrical conductor. A voltage is then supplied to the ends of the inner tube to cause a sufficient current to pass to bring it to such a temperature as may be desired. In forming glowers for Nernst lamps, the glower may be supported in the inner tube in any manner. It is stated that this furnace is also useful for producing a very high temperature where it is desired to treat any materials that may be inserted within the tube.

Of the nine patents remaining for mention, seven were issued to Alexander Jay Wurts, one to Alexander Jay Wurts and Marshall W. Hanks, and one to Alexander Jay Wurts, Marshall W. Hanks, Frederick M. Goddard and Edward Bennett. The latter has for its object to provide a non-conducting support for glowers and heaters of Nernst lamps, which shall be simple, compact and inexpensive in construction, and upon which the heaters and glowers may be independently and detachably mounted. The mountings of the heaters and glowers are such that the removal of the latter may be effected by merely loosening a pin or screw, and the removal of the former by withdrawing a bolt. The patent goes into considerable detail as to the methods of mounting the glowers, heaters and globe, its object being

apparently to cover the construction of a commercial form of the Nernst lamp. The Wurts and Hanks patent is on the constructional details of a Nernst lamp in which damage through heat is obviated by the employment of removable disks for supporting the glowers and terminals, and a disk for supporting the heater, the said disks being connected by heat-resisting materials.

The first in priority of number of the Wurts patents is on a multiple Nernst lamp in which the glowers are located within such proximity as to receive heat from each other, and an electric heater is supplied for heating a selected number of glowers to conductive temperature. Means are provided for causing current to flow through the heater and also through the selected glowers, and means for cutting out the heater when the glowers become conductive. But a single electromagnet is provided to withdraw the heater from action, its core being wound with multiple coils, each coil having its circuit connections through a corresponding glower. The next in order of the Wurts patents is on a system for igniting groups of Nernst lamps, such as are likely to be found in large rooms, halls, factories, and the like. The electric heaters which bring the glowers of the lamps to a conductive condition are arranged in series near the lamps, and both the heater circuit and individual lamp circuits are supplied with suitable switches for closing and opening the circuits; the heater circuit may be supplied from a separate source, or it may derive its current from a transformer interposed between the mains which supply the lamps. By the means here employed it is made possible to remove all automatic devices and movable parts from the lamp structures. When the heater circuit is closed such lamps as have their lighting circuits closed will, after a very short time, light up, after which the heater circuit will be opened. If one or more lamps have been lighted, and it is desired to light an additional lamp, this may be done by again closing the heater circuit after the lighting circuit of the additional lamp has been closed. In this way as many additional lamps may be lighted at a time as may be desired by simply closing the lighting circuits of the selected lamps and then closing the heater circuit. The second Wurts patent describes a system very similar to that just referred to, in this case all lamps being started up simultaneously from a central point. A third patent has for its object to make it impossible for the heater to burn out, and to prevent the heater circuit from becoming closed, even though all or nearly all of the glowers should be extinguished. This result is accomplished by providing in the latter a switch so constructed that when the solenoid core is once raised to open the heater circuit, it cannot descend and again close the heater circuit until the lamp is switched off, and thus the danger of burning out the heater circuit is avoided. On the other hand, as soon as the glower is thrown out of circuit by the operation of the switch, the core is free to descend into its original position.

Another Wurts patent has for its object to obtain a good mechanical and electrical union between the fixed and removable parts of lamps belonging to the Nernst class. Split tubes are employed as junction elements of one set of terminals, and posts or pins adapted to fit tightly into the tubes as junction elements of the other side of terminals. As drawn, the fixture terminals end in split tubes, while the corresponding terminals on the removable part of the lamp appear as posts or pins, the tubes being adapted to spread somewhat in passing over the ends of the posts or pins, whereby a good mechanical and electrical union between the removable parts is effected. Another patent is on a means for heating high-voltage glowers. In the case of high voltages, the single heater would involve danger of flashing between the heater and glower, and might otherwise be dangerous to employ. As illustrated, three heaters are disposed adjacent to different portions of the glower, and thus acting, so far as the heating effect is concerned, as would a single heater extending throughout the entire length. The heaters are supplied with energy from secondaries of a transformer having a single primary winding. The final Wurts patent is on a system of distribution where Nernst lamps are employed. The glowers of all of the lamps in the system are connected in parallel and the heaters of the system, or of any of the groups thereof, are connected in series in combination with a manual operating switch in the conductor supplying the heaters. Each glower circuit has a switch. Means are provided for simultaneously actuating the glower circuit switch for alternately closing and opening the circuits by successively closing movements of the heater-circuit switch.

On the same date, a patent was granted to Charles A. Terry, the object of which is to utilize certain of the peculiar characteristics of Nernst lamps to produce a lamp having a long life. The invention involves an organization whereby when the lamp is connected in circuit the current shall select a path through one or another of two or more glowers, and continue to operate that glower until either the current is withdrawn therefrom or the glower is destroyed; in the latter case, another glower is automatically substituted as the active one. To accomplish this, two or more glowers are connected in parallel with each other and in series with a proper steadying resistance. Owing to the fact that the conductivity of the glower increases with the increasing temperature, that particular glower which offers the least resistance to the flow of current will, in the presence of the steadying resistance, rob the other glowers of current, and only one of the several which are connected in parallel will be operative. The same glower may or may not chance to be the operative one at each successive turning on of the lamp, but it is possible to adjust the relative resistances and characteristics of the several glowers so as to cause them to become operative in a predetermined order of succession. In case the glower which is operating should break or become destroyed, the circuit may be automatically re-established through one or the other of the reserve glowers, and in this manner the practical life of a given lamp may be very great.

CURRENT NEWS AND NOTES.

THE TECHNOGRAPH.—The annual volume of "The Technograph," the organ of the Association of Engineering Societies of the University of Illinois, contains 16 engineering papers, occupying 142 pages. Among the papers is one by William Hand Browne, Jr., on a simple, mechanical device for the solution of wiring problems, which gives graphically the relation of any two elements, such as drop and resistance, when any other two elements, such as load and cross-section, are known. This device was originally described in the *Electrical World*, May 21, 1899, and its application illustrated for the solution of direct-current problems, and the paper in the *Technograph* shows how it may be applied to the solution of problems relating to alternating-current circuits.

THERMOELECTRIC BATTERY.—Two patents were issued June 26 to Joseph Matthias, of Stuttgart, Germany, on a thermoelectric battery of a form which will give great firmness of support to the fragile electrode of a thermoelectric couple, thereby permitting an unlimited application and durability of the elements, and at the same time reducing the resistance to a minimum; and will also permit the electrodes to be united in very large numbers in a relatively small space and allow of an intense cooling action being applied to the side of the eectrode furthest from the source of heat. In thermoelectric piles there is usually one strong electrode of, say, German silver, and another fragile electrode of an alloy of, say, antimony and zinc. These two electrodes are both cast in the form of a prism; the part of the strong electrode away from the fire is formed into a large number of tapering points, and that of the fragile electrode is formed into two wedge-shaped projections. The fire side of the strong electrode is side-flanged, and on this flange the fragile electrode is soldered. The junction at the cool side of the couple is made by means of a thin connecting bridge cast to the pointed ends of both electrodes.

THIRD-RAIL IN THE B. & O. TUNNEL.—After a long and thorough test of a special method of overhead trolley operation, the Baltimore & Ohio Railroad Company has decided to install a third-rail system. The heavy combination of Z-bars which formed the overhead conductor will be removed, and current for the electric locomotives will be supplied by a rail running outside the wheel rails. This rail is to be of the standard A. S. C. E. section, and will weigh 75 lbs. per yard. Four miles of double track will be equipped, extending from the northern to the southern side of the city of Baltimore. According to the proposed plan, in the stations and at some of the crossings where special precautions are desirable, the rail is sectionalized electrically. The Murphy safety third-rail system is here used. To minimize the danger of shocks to the workmen and others who may have occasion to use the tracks, the rail is paralleled on each side by a pine plank set on edge. There is a few inches clearance between these guards and the rail, and the top edge of the plank extends a little above the head of the rail. The insulators consist of blocks of reconstructed granite. These have vertical recesses to receive a pin on a malleable iron casting, which forms the base and extends laterally far enough to support the guard planks. A chair on which the rail rests is leaded on the top of the granite block and completes the insulator.

LETTER TO THE EDITORS.

The Incandescent Lamp and Photography.

To the Editors of Electrical World and Engineer:

Sirs:—I have read with very great interest, in your issue of June 16, 1900, the note on the subject of Prof. F. E. Nipher's investigations in connection with the incandescent lamp and photography. I have tried a number of experiments on the lines of Prof. Nipher's researches, and with confirmatory results. It is stated in the article to which I refer, that a positive and a negative picture necessarily implies a zero picture. I think this is not quite correct. In developing photographs in a strong light—that which I used was an incandescent gas burner of probably about 60 candle-power, at a distance of about 3 ft. from the developing tray—I have noticed that the picture seems to develop first as a negative and then quite suddenly—so suddenly as to be practically instantaneous—it changes to a positive. I have carried the illumination of the plate in the developer a good deal further by developing in broad daylight. In plates developed in this way, it is noticed that, although there are some sharply-defined stains due to the developer not having overspread the plate very rapidly and to the fact also that the development itself is very rapid in this case, there is practically no fog, the greater part of the picture being absolutely clear and positive. This seems to show that a great deal more light can be allowed to shed its rays on the plate than the article to which this refers would indicate.

NEW YORK. EUGENE J. MOYNIHAN.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS, MOTORS AND TRANSFORMERS.

Current-Rushes into Transformers.—CLINKER.—An illustrated article on the momentary rush of current which often takes place through the primary winding of a transformer at the instant of switching it on to a live circuit. This effect is said to be probably due to the fact that the magnetic condition of the iron before the transformer is switched on, depends upon that point in the cycle at which the switch was last opened; when voltage is suddenly reapplied to the primary circuit in such a direction that to produce the necessary back e. m. f., a change of induction is required in the direction in which the iron is already highly magnetized, the permeability of the iron is so low in this direction that a large rush of current is necessary to produce the required change of flux; during the next few seconds the magnetic cycle in the iron does not take place around the zero point, but descends slowly from higher values of induction until it takes place around the zero point. He describes two experiments, in one of which a direct-current ammeter was included in the circuit when switching on; a direct current was found to pass through the primaries of an unloaded transformer for about a minute after the circuit was closed. In the other experiment, the effect was produced more artificially by magnetizing the core in one direction with a direct current; he used two transformers, the low pressure windings of which were in parallel and connected to alternating-current supply mains, while the high-pressure windings were connected so that their e. m. fs. opposed, and were supplied with direct current.—Lond. *Elec.*, June 15.

REFERENCES.

Transformer Tests.—Three illustrated communications describing convenient and practical methods of carrying out tests on the heating, voltage drop, and insulation of a transformer with the usual apparatus available in a central station. They seem to contain nothing new. —Lond. *Elec. Eng.*, June 8.

Polyphase Motors.—GILES.—A continuation of his long, mathematical article on the calculation of polyphase motors (Digest, May 19).—*L'Eclairage Elec.*, May 26.

Synchronous Motors.—EICHBERG.—The first part of his paper in full, an abstract of which was noticed in the Digest May 12. The paper is illustrated by diagrams.—*Zeit. fuer Elek.*, June 17.

Electric Motors.—MAVOR.—The full paper, giving "some considerations concerning electric driving," an abstract of which was noticed in the Digest May 26.—Lond. *Elec.*, June 15.

Sparking.—A brief, illustrated communication on possible effects, which the shape of the slots of the armature core might have upon the tendency to sparking.—Lond. *Elec. Eng.*, June 15.

Couplings.—Two illustrated communications, describing different forms of flexible couplings for use between engine and dynamo.—Lond. *Elec. Eng.*, June 15.

LIGHTS AND LIGHTING.

Incandescent Lamp.—An illustrated description of a new lamp of German make, the base being detachable from the glass bulb containing the filament, so that either portion may be replaced separately when required.—*Elek. Anz.*, May 20; abstracted in Lond. *Elec. Eng.*, June 8.

Nernst Lamp.—A translation, reprinted from the Lond. *Elec.*, with the illustrations, of the German article abstracted in the Digest Mar. 24.—*Sc. Amer. Sup.*, June 16.

Nernst Lamp.—An illustrated description of the device of Siemens & Halske, by which the heating of the vertical incandescent body is done by an arc which gradually rises until it is extinguished, as described in the Digest May 26.—*Zeit. fuer Beleucht.*, May 20.

Artistic Illumination.—A brief, illustrated article on the illuminations during the Pretoria celebrations in Glasgow.—Lond. *Elec. Eng.*, June 15.

Arc Lamp.—An illustrated description of an enclosed arc lamp of Johnson & Phillips, which is said to be cheap, and can be placed in the hands of an untechnical man. The regulating mechanism is described in detail.—Lond. *Elec., Eng.*, June 15; more briefly in *Lightning*, June 14.

Arc Lamp Carbons.—An article on the industrial manufacture of the carbons for arc lamps.—*Rev. de Chim. Ind., L'Elec.*, June 9.

POWER.

Long-Distance Transmission.—FORBES.—A communication in which he replies to Perry's criticism. Against Perry's demonstration that the efficiency of a transmission line, transmitting power from a dynamo to a motor, cannot be less than 50 per cent (as explained in the Digest, June 23), he says that the speed of the motor at the receiving end can be reduced to any amount by increasing the mechanical resistance, and gives an example of a transmission with an efficiency below 50 per cent, where the load, however, consists of lamps instead of a motor. He emphasizes the correctness of the figures, given in his paper, and says that the advantages of the booster method become most important only in special cases of unlimited cheap power, long distance and no excessive voltage.—Lond. *Elec.*, June 8.

Three further communications by Carus-Wilson, Perry and Swinburne, and an editorial note on the same subject. Carus-Wilson would state Perry's argument, as follows: In the instance, quoted by Perry, a motor works at one end of a line having 3 ohms resistance, the voltage at the generator end is 1000, at the receiving end 400, the current 200 amperes, the efficiency 40 per cent; the same motor, if geared to its work with gear ratio 2 to 3, would take 133 amperes and run at 600 terminal volts, with an efficiency of 60 per cent and the same mechanical output as before; the same result could be obtained without gearing, if the motor were wound with 50 per cent more turns on the armature, or if any equivalent alteration were made. In general, if a motor is found running at the end of a transmission line with less than 50 per cent efficiency, it shows that the plant is not properly designed, since the same output can always be obtained with a higher efficiency than 50 per cent, the sum of the two efficiencies being 100.—Perry replies to Forbes, that with a given conductor and generator 1 horsepower can be transmitted with a minimum or with a maximum efficiency, and that Forbes chooses deliberately the most wasteful method and, of course, gets a very low efficiency; when Perry said that less

than 50 per cent efficiency was impossible, he meant "that it was impossible for a competent electrical engineer;" he makes some further calculations and adds a table, to show that Forbes' figures are wrong. —Swinburne writes about mathematics and electrical engineering, and says that "fully two-thirds of the mathematical writing in the electrical press is waste paper, not because the mathematics are faulty, but because the data or assumptions are wrong;" he agrees, however, that first-rate scientific work often demands mathematics of a high order. Regarding the efficiency of transmission lines, he says that as the efficiency of a system with a constant pressure at the generating end goes up with the receiving pressure until it equals the generation pressure, and as the intake of the motor goes up until its pressure is half that of the generator, from this it is clear that it is possible to always get at least 50 per cent.—Lond. *Elec.*, June 15.

Canadian Water-Power Plant.—An illustrated description of the transmission plant of the Lindsay Light, Heat & Power Company. The power of the falls of the Gull River, at Fenelon, is utilized, the capacity of the plant being 650 horse-power, while it may be extended to a total output of some 1000 horse-power. Three-phase currents at 550 volts is generated and transformed up to 11,600 volts for transmission over the 14-mile transmission line to the sub-station in Lindsay, where it is transformed down for distribution to the lights and motors throughout the town.—*Can. Elec. News*, June.

Electrical Energy from Peat.—FRANK.—An article proposing to utilize the great peat beds of Northern Germany for the production of electricity on a large scale. He estimates that a hectare of turf, three metres thick, gives 2500 tons of dry turf, equivalent to 1200 tons of coke. The mosses of the Evus Valley, which cover an area of 1000 square miles, might furnish the equivalent of 300,000,000 tons of pit coal. He proposes to burn the turf at central stations of 10,000 horse-power capacity, consuming annually 200,000 tons of turf, the product of 200 acres of the beds; the main purpose would be the production of acetylene.—*Stahl und Eisen*; abstracted in *Sc. Amer. Sup.*, June 23.

Refuse Destructors.—GOODRICH.—A communication criticizing the anonymous article, noticed in the Digest June 23, 30, which is said to be hopelessly pessimistic. He refers to the installation of Darwen, where in September last a destructor of eight cells and two boilers was erected; from that time up till now, with one unit of four cells and one boiler, the whole of the refuse has been thoroughly destroyed, and the one boiler day and night gives sufficient steam at nearly 200 lbs. pressure to the square inch, to develop the power for the electric lighting of Darwen.—Lond. *Elec. Rev.*, June 15.

Electric Driving.—An editorial, giving some comparative figures of the cost of electrical energy in England and other countries, from steam and water power. It is pointed out that this cost is not of great importance for the question of electric driving in factories, as the cost of energy consumed in turning out the finished product is very small, and generally below 2 per cent of the price charged for the manufactured article. The real value of the electric system lies in its extreme flexibility, regularity, and ease of control, by virtue of which features the output of a factory may be increased by from 10 even to 50 per cent, with the same or less consumption of energy.—Lond. *Elec. Rev.*, June 15.

Electric Drill.—A brief, illustrated description of an electric drill, now being tried in some Colorado mines. The drill is of the reciprocating type, motion being given to it by a revolving shaft run at high speed; the drill guide is circular, and the operation is similar to that of a piston. The motor is enclosed in a box, which is dust and moisture proof, and is connected to the drill by a flexible shaft, a small starter at the rear end of the drill being provided, which gives the operator instant control in starting and stopping. The mechanical features of the drill are described; it strikes a blow equal to about 200 lbs., delivering from 500 to 700 blows per minute.—*Eng. and Min. Jour.*, June 23.

Efficiencies of Gas and Steam Engines.—DESEGUNDO.—An article in which he refers to tests, made by Kennedy, of a gas engine, by which he found an absolute efficiency (ratio of work done and heat supplied) of 25.6 per cent; that of a Westinghouse gas engine is 31.8 per cent; the best results in steam engine performance he knows of, give an absolute efficiency of 22.8 per cent. He then calculates the theoretical maximum efficiencies, which can be obtained with the temperatures used in the machines, according to the principle of Carnot: this is 78.2 per cent for Kennedy's gas engine and 26.5 for a steam engine. Therefore, the "relative efficiency," i. e., the ratio between the actual efficiency and the maximum theoretical efficiency, is 32.7 per cent for Kennedy's gas engine and 80 per cent for the steam engine; it is estimated at 52.3 per cent for the Westinghouse gas engine. "Although there is no doubt that more room for improvement exists in the case of the gas engine heat efficiency than in the steam engine, still it may fairly be assumed that on practical grounds the limit of efficiency must now have been nearly reached in the gas engine. It is probable that the steam engine will always be a more efficient machine than the gas engine for turning heat into work, having regard to the respective limitations of the two machines."—Lond. *Elec. Rev.*, June 15.

REFERENCES.

Three-Phase Transmission.—LENNER.—A paper, read before the Italian Association of Elec. Eng., in which he treats graphically the power transmission by three-phase currents with star connection.—*L'Elettricista*, Apr. 1; the first part of a German translation of the paper in *Elek. Neu. Anz.*, June 1.

Power Supply to the Small Consumer.—KENNEDY.—A brief article, in which he says that it is a fallacy to believe that small power users will be encouraged and increased in numbers by the placing within their reach a cheap power supply. The great demand for ordinary manufactured articles can never be met, except by the large factory; only by using extensive plant and sub-dividing labor in a large, organized factory can production cope with demand at present prices.—Lond. *Elec. Rev.*, June 15.

Electrically-Operated Safety Doors.—An illustrated description of a system, devised by Bowles, of operating electrically the safety doors of the water-tight compartments of steamships. The system is used on the U. S. S. Atlanta and on the St. Paul.—*El'ty*, June 20.

Electricity in Coal Mines.—PERKINS.—An illustrated description of several forms of coal-cutting machines.—*Sc. Amer.*, June 23.

TRACTION.

Electric Traction.—BINYON.—An abstract of a paper read before the London Society of Engineers. He first compared the London traffic with that of New York. He favors the overhead trolley system as most efficient and economical, and advocates the side trolley to obviate the unsightliness of very long brackets. He believes that the London electric tramway companies will in time force railway companies to adopt electric traction, even for suburban traffic within a radius of from 10 to 25 miles round London; beyond this limit, he thinks that the steam locomotive will beat its electric rival. For combined lighting and traction plants, he advocates completely separate dynamos and mains. The power consumption of cars weighing about 12 tons, with speeds of from 6 to 12 miles per hour, and with stops of from 8 to 10 seconds, is given in a table. At a speed of 6 miles, with 6 to 14 stops per mile, the power consumed at the trolley wheel is 0.7 to 1.08 kilowatt per car; at a speed of 9 miles, with 4 to 9 stops, 0.73 to 2 kilowatts; at a speed of 12 miles, with 3 to 6 stops, 0.73 to 2.04 kilowatts. The use of meters in the cars is recommended, for the reason that from 30 to 40 per cent in power of the waste caused by the careless handling of controllers could be saved.—Lond. *Elec.*, June 15; *Lightning*, June 14.

Electric Traction under British Conditions.—SAYERS.—A communication, replying to the editorial noticed in the Digest June 30. He says that the questions of the best system of generation were not touched upon in his paper, which dealt with the calculation of distributing systems. What he tried to show is: that it is possible to calculate conductor systems and the cost of distribution upon general principles, and he applied those principles to a given case as an example; the cost of generation was taken as a constant and identical in each of the three arrangements suggested; he pointed out that the results show what saving has to be made by generating the energy at a single station to overcome the increased cost of distribution; he claims that this method of treating the matter is the best and most practical way of approaching the consideration of the best means of supplying power to a particular system of tramways or light railways. The supply of electrical energy to a whole county, and the question whether such supply in bulk is likely to prove more advantageous to all concerned than supply to smaller districts from many stations, are questions of a quite different character.—Lond. *Elec.*, June 15.

Central London Railway.—A continuation of the long, well-illustrated article on this underground railway (Digest, June 23, 30), giving a detailed description of the synchronous converter sub-stations. The normal output of each sub-station is 1800 kilowatts, but this can be increased on occasion by 20 per cent without any difficulty; each contains 7 transformers and two synchronous converters.—Lond. *Elec. Rev.*, June 15; a well-illustrated article on the same railway is continued in Lond. *Elec.*, June 15.

REFERENCES.

Automobile Tests.—An abstract of the rules for the 1901 trials of motor vehicles for heavy traffic, to be arranged by the Liverpool Self-Propelled Traffic Association. A requirement for electric automobiles is that they must have a battery sufficient to travel 40 miles with one charge; among the points to be considered there will be the devices for varying the discharge rate, the method of carrying the battery and replacing the same, the simplicity of the controller, and the energy consumption per mile.—Lond. *Elec. Eng.*, June 15.

Preventing Electrolysis.—A note on a project of a tramway company in Newark, N. J., to lay underground conduits for feed and return wires, the latter being connected to the rails. All the rail joints will be cast welded. The prevention of electrolysis, however, is only incidental to this joint work, its main object being to give a better rail support and cut down coal consumption.—*Eng. News*, June 21.

Traction Engines.—BOOTH.—An article on the economy of simple or compound engines for traction work. He points out the advantages of the former type for that purpose.—Lond. *Elec. Rev.*, June 15.

Return Railway Feeders.—BOEHM-RAFFAY.—The continuation of the translation of his mathematical investigation, noticed in the Digest, Mar. 25, Aug. 26, Sept. 9, 1899, and Jan. 6, 1900.—Lond. *Elec. Rev.*, June 15.

3000-*Volt, Three-Phase Railway.*—E. K. SCOTT.—A reprint of the article on the Colico line in Italy, noticed in the Digest, June 30.—*El'ty*, June 27.

Electric Automobile.—RIKER.—The full N. Y. Elec. Soc. paper, abstracted in the Digest, May 5.—*Sc. Amer. Sup.*, June 23.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Asylum Electric Installation.—An illustrated description of the electric installation of the Wakefield Lunatic Asylum. In the steam-driven power plant current at about 420 volts is generated, which is supplied by means of a motor balancer to a three-wire system, with 210 volts on each side. The current is used for lighting 2700 incandescent lamps, driving motors in the laundry, bakery, etc., and for heating. Every ward and laboratory is provided with one or more electric heaters, 5-ampere size, for boiling purposes, and, in addition, some of the isolated rooms, where it is difficult to supply steam heating, are heated with several heaters, taking as much as 24 amperes at 200 volts each.—Lond. *Elec. Rev.*, June 15.

Electric Safety Lift Clutch.—An illustrated description of the Bush-Jenkins electric safety lift clutch, which is claimed to render impossible accidents on lifts and hoists. The locking of the lift gates or doors is done automatically, and does not interfere with the working of the lift. A special feature is that it is impossible to start the lift when the door is open, and no other door can be opened except the one at which the lift is stationary.—Lond. *Elec. Eng.*, June 15.

REFERENCES.

Lighting Installation.—An illustrated article on the electric lighting of the London Hippodrome; there are 2000 incandescent and 20 arc lamps.—Lond. *Elec. Eng.*, June 15.

City of York.—An illustrated description of this municipal continuous lighting station of this English town, the present capacity being 200 kilowatts.—*Lightning*, June 14.

ELECTRO-PHYSICS AND MAGNETISM.

The Spark Due to the Break of an Electric Circuit.—JOHNSON.—A mathematical article, in which he considers the circuit of a single coil and a battery, with a make-and-break apparatus. He first supposes that the terminals of a condenser are fastened on either side of the interrupter, and shows later that there is little difference, in considering the spark or its suppression, whether the capacity is situated at the ends of the broken circuit, or is uniformly distributed along the whole length of the circuit. He develops the formulas for the potential difference and the current, if the spark is entirely suppressed.—London *Elec.*, June 15.

Magnetized Coherers.—TISSOT.—A French Academy note, in which he says that his coherers, described in the Digest May 26, have been applied with great success to the exchange of wireless messages between French battleships and a lighthouse. The filings in the coherer and the iron terminals are kept very dry, and are best enclosed in a tube hermetically sealed and containing a few fragments of calcium carbide. The e. m. f. of the circuit may be varied within wide limits without interfering with the clearness of the signals. The ordinary resistance of the coherer is from 200,000 to 500,000 ohms. At coherence, it falls to something between 1500 and 3000 ohms. The fall of resistance in magnetized coherers is not entirely due to the impact of the waves; the increase of current strength itself brings about a further fall.—*Comptes Rendus*, May 21; abstracted in Lond. *Elec.*, June 15.

Examination of Coal by Röntgen Rays.—KOTTE.—An illustrated account of experiments, which show that the Röntgen rays cannot be used for accurately determining the quantity of ash yielded by various fuel, for which purpose their use had been suggested, as noticed in the Digest Apr. 7. Small boxes were filled with different powders of coal, placed on a photographic plate, and subjected to the action of Röntgen rays; the images showed great differences, although all specimens contained the same quantity of ash; these differences correspond with the various quantities of iron contained in the specimens.—*Stahl und Eisen;* abstracted, with illustrations, in *Sc. Amer. Sup.*, June 23.

Magnetic Properties of Alloys of Iron and Aluminum.—RICHARDSON AND LOWNDS.—An abstract of a British Physical Society paper, in which they give an account of a continuation of their researches. They investigated in what way hysteresis loss, between given limits of the field strength, is connected with the temperature, for an alloy containing 3.64 per cent of aluminum. The hysteresis loss at first diminishes as the temperature rises; it then increases and reaches a maximum at about 550 degs. C.; on further heating it falls off rapidly and is negligible at 700 degs. C. The magnetic properties of the specimen depend largely on its previous history. There is no essential difference between the behavior during heating and cooling, except near the temperature of minimum permeability. An abrupt increase in the permeability takes place at about 650 degs. C. during heating, followed by an equally abrupt diminution on further heating; this abrupt change is more marked with falling than with rising temperatures. Continued heating and cooling diminish the permeability. The curve connecting temperature of minimum permeability and percentage of aluminum is a straight line.—Lond. *Elec.*, June 15.

REFERENCES.

Power of Alternating-Current Circuits.—SIRE DE VILAR.—A mathematical article, in which Steinmetz's fundamental rules for the representation of the power of alternating-current circuits by complex imaginary quantities are developed in an exact but rather roundabout way with the aid of calculus.—*L'Eclairage Elec.*, May 19.

Active Principle of Uranium.—CROOKES.—An account of experiments by which he succeeded in isolating the radio-active principle of uranium; it is about 300 times more active than uranium.—*Royal Society* paper, read May 10, 1900; abstracted in Lond. *Elec.*, June 15.

Rarefied Air.—SCHMIDT.—An abstract of his paper on the influence of temperature on the potential fall in rarefied gases. (Digest, June 16.)—*Elek. Zeit.*, May 24.

Energy of Cathode Rays.—CADY.—An abstract of his paper, noticed in the Digest June 2.—*Elek. Zeit.*, May 24.

Cathode and Röntgen Rays.—GRAETZ.—An account of experiments in which he produced a rotation of spheres of paraffine, sulphur, or ebonite under the influence of cathode and Röntgen rays.—*Ann. der Physik.*, p. 648; abstracted in *Elek. Zeit.*, May 24.

Arcs between Metals.—ARONS.—An abstract of his paper, noticed in the Digest June 2.—*Elek. Zeit.*, May 24.

Electrolytic Current Records.—GRUETZNER.—An illustrated abstract of his paper, noticed in the Digest June 2.—*Elek. Zeit.*, May 24.

Thermoelectricity.—ADAMI.—A communication on the measurement of small thermoelectric forces. He describes briefly some experiments with thermoelectric forces produced by heating one or several points of a copper wire.—*Elek. Zeit.*, May 24.

ELECTRO CHEMISTRY AND BATTERIES.

Electrolytic Bleaching.—KERSHAW.—An article on the production of bleaching compounds by the electrolysis of solutions of the alkali metal chlorides or of magnesium chloride. The principle of electrolytic bleaching depends upon the production of hypochlorite of sodium or magnesium, by combination of the chlorine liberated at the anode, and the hydrate formed at the cathode. The chemical equations of the process are given, and the conditions requisite for the production of bleaching solutions are shown to be: insoluble electrodes, no diaphragms, low temperature of the electrolyte, and rapid circulation of the electrolyte from the cathode towards the anode. The tendency

now observed in the textile industries to adopt electric power, will hasten the development of the electrolytic bleaching industry; for if there is a generating plant for lighting and power purposes, an electrolyser and two storage vats are the additional plant required. He gives brief descriptions of electrolysers in actual use: those of Hermite, Stefanow, Kellner, Woolf, Corbin and Vogelsang, and gives some comparative figures of the cost of the processes. Theoretically, to obtain 1-kg chlorine in the form of hypochlorite, an expenditure of current equal to 1512 amp.-hours, and of electrical energy equal to 4.73 hp-hours is required. In a table he gives the energy efficiencies of various electrolysers in per cent of the theoretical energy: Corbin 42, Hermite 46, Kellner 50, Vogelsang 71, Woolf 63. In the absence of details concerning the current density used, these figures are not of great practical importance, as a high energy efficiency may be obtained under conditions which would not be economical in actual work. In electrolytic bleaching, as in other electro-chemical operations, the problem is to find the point at which increased output per unit of plant ceases to be remunerative, owing to the increased e. m. f. required to operate each decomposing cell. He thinks the most satisfactory form of electrolyser is one provided with a large number of secondary electrodes, and thus capable of utilizing a fairly high e. m. f. between the two terminal electrodes, the Kellner, Corbin and Vogelsang electrolysers being examples of this type. He gives some figures on the Kellner electrolyser taken from practical trials. The cost per kilogram of active chlorine is 14½ cents. He gives comparative figures of the costs of actual trials with solutions prepared from bleaching powder, and from common salt by electrolysis in the Kellner electrolyser. In a trial with 2800-kg of light calico goods for dyeing and printing, the total cost of chemicals was $1.05 for the electrolytic method, and $3.47 for the older method with bleaching powder. In another trial with 3450-kg of heavy calico for white goods, the total cost of chemicals was $2.11 for the electrolytic method, and $5.26 for the older method with bleaching powder.—Lond. *Elec.*, June 15.

Phenix Battery.—DAVID.—A description of this accumulator, the feature of which is the form of the electrodes, which are not plates, but are composed of a great many small cylinders. Each cylinder consists of a hard lead rod of 0.08 inch diameter and 3 inch length, 2.8 inch being covered with a layer of active material of 0.08 inch thickness; upon this cylinder, 170 to 200 small ebonite disks are mounted of 0.012 to 0.016 inch thickness and 0.2 to 0.4 inch diameter, so that the active mass is held in position, while the electrolyte and the gases can pass freely. The capacity of a pair of these cylinders is small, about 0.35 amp.-hours only, so that for an accumulator with 100 or 6500 amp.-hours' capacity, about 280 or 17,500 electrodes respectively, are required. The Phenix accumulator participated in the competitive tests of the Automobile Club of France, as noticed in the Digest Feb. 10, where also some figures about the behavior in the tests are given.—*Centralblatt fuer Accum. und Elem. Kunde,* June 15.

Electrolysis of Fused Salts.—LORENZ.—An account of experiments, which show the great importance of keeping the electrodes apart, and indicate the conditions under which trustworthy values of the e. m. f. of polarization and its temperature coefficient can be obtained. The current yield in the electrolysis of fused lead chlorine diminishes rapidly as the temperature rises, and becomes zero at the boiling point of the salt; this rapid fall is due, not only to the accelerated diffusion of the lead and chlorine vapor in the fused mass, but also to the increasing vapor tension of the lead. At constant temperature, the yield increases with the current density and with the distance between the electrodes; it diminishes as the depth of immersion of the anode increases. A tube with the electrodes close together is an unsuitable and uneconomical form of apparatus for the electrolysis of fused salts; with such an arrangement, the longer the experiment lasts, the poorer is the percentage yield, owing to the more complete diffusion of the products.—*Zeit. fuer anorg. Chemie.*; abstracted in *Jour. Chem. Soc.*; Lond. *Elec. Eng.*, June 15.

REFERENCES.

Alkali Processes with Diaphragm.—FOERSTER and JOWE.—An account of an experimental investigation of the electrolysis of neutral alkali chloride solutions, a diaphragm being used.—*Zeit. fuer anorg. Chemie.*; abstracted in *Jour. Chem. Soc.*; Lond. *Elec. Eng.*, June 15.

Migration of Ions.—MUELLER.—An illustrated description of an apparatus for demonstrating in the lecture room the migration of the ions in electrolysis.—*Zeit. fuer Elektrochemie,* June 14.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Frictionless Motor Meter.—EVERSHED.—The conclusion of his paper (Digest, June 30), giving illustrations and brief descriptions of the details of his meter. The standard range of his uncorrected meter is 1 to 250; it may be greatly extended by introducing a device to compensate for friction. He thinks, however, that if advantage is taken of the enormous reduction in friction to improve the meter in other ways, even at a sacrifice of some part of the long range, a more generally serviceable instrument will be secured. A reduction of range enables a large reduction of the power wasted in the armature circuit, but a limit to this reduction is given by the fineness of the wire it is possible to use upon the armature and in the series resistance; on this account, it is at present not advisable to reduce the pressure current below 0.01 ampere, and this value has therefore been adopted for all voltages. An additional improvement in accuracy has been secured by making the meter astatic. The initial value of friction is compensated for by means of a little strip of sheet iron placed within the field of the main coils; when once magnetized by the main current, the coercive force of the iron is sufficient to provide the very small driving moment required to overcome friction. The corrected meter starts with from 0.002 to 0.003 full load, and has a standard range of about 1 to 200. He describes some tests for endurance, and says that it seems not impossible to bring the initial friction in a new meter down to about 1 dyne cm.—Lond. *Elec. Rev.*, June 15. A continuation of the illustrated reprint of this paper in Lond. *Elec. Eng.*, June 15; the first part of the paper in Lond. *Elec.*, June 15. An illustrated description of the Evershed meter, by Aliamet, in *L'Elec.*, June 17.

Electric Pendulum.—FERY.—A description of an electrically-driven pendulum. A permanent horseshoe magnet is attached to the bob of the pendulum, and one arm of it passes at every swing into a coil through which a constant quantity of electricity is sent just at the moment at which the pendulum is passing through the vertical. The quantity of electricity is kept constant and independent of the state of the possibly inconstant battery, in the following way: A balancing arm bears at its ends two coils which fill up the spaces between the poles of two horseshoe magnets. The arm is of soft iron, and when a current traverses either of the coils, it is temporarily magnetized. One of the coils is the "motor" coil, and receives the current from the battery. It is attracted by the electromagnet against the force of a spring, and thus brings about a definite displacement of the other coil in its magnetic field. The induced current caused by this displacement traverses the coil which receives the magnet attached to the bob, and thus gives to the latter the impulse required. With an e. m. f. of 10 volts, the current required is of the order of a milliampere, and the amount of zinc consumed in a whole year would not exceed 20 grammes.—*Comptes Rendus,* May 7; *L'Ind. Elec.*, May 25; abstracted in Lond. *Elec.*, June 15.

Mercury Interrupter.—CALDWELL.—An illustrated description of a new type of mercury interrupter. In its simplest experimental form it consists of a small, soft rubber tube about a foot long, closed at each end with a steel plug, and filled with clean mercury which makes contact with the two steel plugs; the primary circuit of the induction coil is completed through the mercury column; if the middle of the tube be squeezed between the thumb and fingers, the mercury column will be separated into two portions and the circuit will be broken suddenly and without visible spark. In another form of the interrupter the separation of the two portions of mercury is effected by a sort of poppet valve made of an insulating material. In a third form an outer vessel contains an inner tube of insulating material, which is closed at the bottom by a flat plug perforated with a small orifice; a disc of insulating material, perforated with a number of holes near its circumference, is arranged to revolve in close proximity to the lower end of the insulating tube, so as to open and close the orifice in the plug at the bottom; the outer vessel and the inner tube are partially filled with mercury, and electrodes of steel are placed in both.—*Elec. Rev.*, June 20.

Short-Circuit Key.—An illustrated description of a short-circuit key, devised by Rymer-Jones, to be used not only as a tapper, like the ordinary short-circuit key, but to more perfectly short-circuit the galvanometer when it is desired to check the instrument zero. In the ordinary form of the key the contact points are only pressed together vertically, by means of the brass spring strap, and any dirt accumulating between the points is only compressed, which tends to increase the contact resistance. In his new key a connecting strap is raised and moved over a rubbing contact, which, being of wide surface, firm,

and always kept clean by friction, is relied on to offer no resistance.—Lond. *Elec. Rev.*, June 15.

REFERENCE.

O'Keenan Meter.—An illustrated description of this meter, which was noticed in the Digest Dec. 9 and 30.—*Elek Zeit.*, May 31.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Interception of Wireless Telegrams.—TOMMASI.—A French Academy note, in which he suggests to use two transmitters of different ranges of action. The transmitter with the larger range is used for sending the message to the station for which it is intended, while the transmitter with the shorter range is used to confuse the message within that range by an unmeaning series of dots and dashes. The range of a transmitter may be adjusted by altering the size of the spark-gap, and thus it should not be difficult to restrict the chances of interception to a zone of, say, half a mile.—*Comptes Rendus*, May 14; abstracted in Lond. *Elec.*, June 15.

Wireless Telegraphy.—VALLOT AND LECARME.—An account of successful experiments with telegraphy by Hertzian waves between the earth and a free balloon at a great distance and without a conductor connecting the receiver to the earth. The signals were heard very distinctly in the balloon at a height of about 600 yards, the horizontal distance being about three miles; they were still noticeable at a height of 900 yards and a distance of nearly four miles, but it was necessary to increase the sensibility of the apparatus.—*Mon. Indust.*; abstracted in Lond. *Elec. Eng.*, June 15.

REFERENCES.

Telegraphy and Telephony.—A summary of the progress of telegraphy and telephony in the first three months of 1900, giving brief descriptions of new inventions, taken from patent specifications, and also some information on the development of telegraphy and telephony in different countries.—*Elek. Ans.*, May 27, 31.

Ohio.—A brief article, with a map showing the independent telephone toll lines and exchanges in the State of Ohio.—*Elec., Rev.*, June 20.

Submarine Cable.—BRADSHAW.—An article on the first submarine cable, giving an account of the work of J. B. Sleeth.—*Sc. Amer.*, June 23.

Telephonic Experiment without Battery.—An illustrated description of the experiment of Pierard, noticed in the Digest Apr. 28.—*Elek. Zeit.*, May 31.

Multiplex Telephony.—FLEURY.—An illustrated article on Mercadier's system, with transmitting tuning forks and receiving "monotelephones," noticed in the Digest May 5.—*L'Elec.*, June 9.

Telephonograph.—An illustrated article on the instrument of Poulsen, described in the Digest June 23.—*Elec. Rev.*, June 20.

MISCELLANEOUS.

Stassano Process for Electrically Producing Iron and Steel.—KERSHAW.—An article on the efficiency of the Stassano process (Digest, Sept. 30, Oct. 28, Nov. 11), which is to be used in a plant now in course of erection in Italy, capable of producing 4000 tons of iron per year; 1500 horse-power will be used at this plant in three furnaces of the Stassano type. The iron ore is reduced to a state of fine division, and is mixed with the requisite proportions of lime and coke similarly ground to powder; the mixture is then moulded into briquettes with a suitable binding material, and these are heated in the electric arc in the specially-designed furnaces; the operation of the furnaces is continuous, arrangements being made for tapping the slag and the reduced metal at regular intervals of time. He gives brief notes on theoretical and experimental researches of different authors on the efficiency of electric arc heating. He says that electric arc heating cannot be an economical method of effecting a reduction that takes place at a comparatively low temperature, and that in the Stassano furnace a large number of chemical and physical changes in the solids and gases must be brought about, which are not necessary for the conversion of ferric oxide into metallic iron, and simply represent wasted energy. He refers to the statement of the Italian Company that originally 4.08 hp-hours yielded 1 kg of manganiferous steel of good physical properties, but that improvements have been made which now reduce the energy consumption to 2.7 hp-hours per kg. He gives an itemized comparison of the cost of the Stassano process and of the ordinary blast furnace process. Taking the price of coke in Great Britain as $5.50 per ton, he finds that the net saving in coke by use of the electric arc for heating amounts to less than $2.75 per ton of iron produced; against this gain one has to place an expenditure of from $3.25 (based upon the price of energy in Italy) to $6.75 (price of energy at Niagara) per ton of metal produced by the Stassano furnace, for electrical energy, plus the increased cost of preparing the ore for treatment by grinding, mixing and formation into briquettes. It is claimed by the Italian company that the metal obtained from the Stassano furnace is a maganiferous steel of high carbon contents, and that its value is, therefore, considerably higher than the metal produced by the blast furnace; but Kershaw awaits the results of further practical trials in this regard. He thinks it to be improbable that the electrical method of iron and steel production will enter into active competition with the older blast furnace method of manufacture in countries where fuel is reasonably cheap, and the Stassano process is only likely to prove successful at present in countries where fuel is expensive, water-power abundant, and heavy protective tariffs on iron and steel exist. By the promoters of the Italian company the following figures are given. Owing to the scarcity of fuel in Italy, ordinary smelting costs $32 per ton of iron, of which total $6.60 represents the value of the fuel used for heating purposes. By the Stassano process this fuel is replaced by electrical energy costing $3.60, and the whole process is carried out at a cost of $20 per ton, a saving of $12 per ton as compared with the cost of the older process.—Lond. *Elec. Rev.*, June 15.

Germany.—KERSHAW.—The conclusion of the article, noticed in the Digest June 30, giving abstracts of the reports for 1899 of Schuckert & Co., the General Electric Co. of Berlin, the Helios Co., the Union Elec. Co. and Ganz & Co.—*Lightning*, June 14.

RAWORTH.—A communication, referring to the first part of Kershaw's article, from which he concludes that the total German profit from electrical manufacturing must be from 12 to 15 times larger than the British. "It is true that wages are lower on the Continent than in England, but in America they are higher, and yet America can beat both England and Germany in price." He infers, the drawback of electrical engineering in Great Britain lies in the restrictions set by legislation, in the control by the Board of Trade, in the tendency to municipalization, and in the price of gas. Gas is very cheap in England, and the gas industry grows more rapidly than the electrical industry.—*Lightning*, June 14.

REFERENCES.

Paris Exposition.—A very well illustrated description of a 2500-hp triple-expansion engine of Borsig, Berlin, directly connected to an alternator of Siemens & Halske, installed at the Exposition to provide current for lighting the buildings on the Champ de Mars.—*Eng. News*, June 21.

An illustrated article, describing the moving platform, the sub-station of the Westinghouse Co., and a Willans-Siemens 2400-hp steam dynamo.—Lond. *Elec. Eng.*, June 15.

DE MORSIER.—An illustrated article on the generation and distribution of the electrical energy at the Exposition.—*Revue de l'Elec.*, June 15.

An illustrated description of a steam-driven, 825-kw, three-phase alternator of Kolben & Co., installed at the Exposition.—*Zeit. fuer Elek.*, June 17.

DAVID.—The first part of a series of articles on the storage batteries exhibited. This part deals with the Phenix battery (see the abstract under Electro-Chemistry).—*Centralblatt fuer Accum. und Elem. Kunde*, June 15.

A very full account, filling the entire issue, of the organization of the electrical part of the Exposition. The general plan of the ground floor and of the second floor of the Palace of Electricity is given in two double-page plates.—*L'Ind. Elec.*, June 10.

Books Received.

THE KNIGHT OF THE GRIP. Being a Series of Dissertations on His Conditions, Character and Conduct as They Appear to an Ordinary Chap who has Studied Him. Reprinted from the *Iron Age*. New York: David Williams Company. 179 pages, illustrated. Price, 60 cents.

HORSELESS VEHICLES, AUTOMOBILES, MOTOR CYCLES, Operated by Steam, Hydro-Carbon, Electric and Pneumatic Motors. By Gardner D. Hiscox, M.E. New York: Norman W. Henley & Company. 459 pages, 316 illustrations. Price, $3.00.

Northwestern Electrical Convention.

The summer meeting of the Northwestern Electrical Association at Waupaca, Wis., last week was well attended by representatives of the electrical trade, who, as usual, brought to the attention of the delegates the latest developments in central-station apparatus and material. Formal acknowledgment of the aid lent by associate members in making the meeting a success was tendered on the floor at the opening session by Secretary Mercein, who said that the greater part of the expense of entertainment was contributed by Chicago electrical firms; and at the close of the meeting a resolution was passed tendering the thanks of the association to Mr. James Wolff, Mr. W. W. Low and Mr. George S. Whyte for their individual efforts in making the convention a success.

The Electric Appliance Company, Chicago, was represented by President W. W. Low, who was assisted by Mr. B. B. Downs.

The Hart & Hegeman Manufacturing Company, of Hartford, Conn., placed its Chicago manager, Mr. George S. Searing, in charge of its interests, which were well taken care of.

The Peru Electric & Manufacturing Company, Peru, Ind., was also represented by Mr. Searing.

The New York Insulated Wire Company, of New York, placed James A. Wolff, its Chicago manager, in charge of its interests.

The Varney Electrical Supply Company, Indianapolis, Ind., was ably represented by President G. E. Varney.

The New York & Ohio Company, Warren, Ohio, had Mr. W. D. Packard in charge.

The American Circular Loom Company, New York, was represented by President H. B. Kirkland, assisted by Mr. Thomas Grier, of Chicago.

The Illinois Electric Company was represented by President S. K. Cushing.

The Dearborn Drug & Chemical Company, Chicago, was taken care of by President William H. Edgar.

The Westinghouse Electric & Manufacturing Company was represented by Mr. W. R. Pinchard, of Chicago.

The Hatch Electric Smelting Company, of Green Bay, Wis., was represented by President F. E. Hatch.

The American Steel & Wire Company was represented by Mr. Channing T. Gage, its St. Paul representative, who handed round a very useful souvenir in the shape of a fishing hook, which was in constant demand.

The Central Electric Company, Chicago, was represented by Mr. W. W. Geisse.

The Fort Wayne Electric Works was represented by Mr. Frank McMaster, of Chicago.

The General Incandescent Arc Light Company was represented by Mr. Francis Raymond, of Chicago; Mr. Millard B. Kitt, of Minneapolis, and Mr. Thomas James, of Milwaukee.

The United States Carbon Company, Cleveland, Ohio, was represented by Mr. George Rose Newcomer.

The Shelby Electric Company, of Shelby, Ohio, was represented by Mrs. M. West, whose high praise of the Shelby Company's goods had much effect. Mr. O. D. Pierce was also present.

The General Electric Company was taken charge of by Mr. Thomas Ferris, of Milwaukee, and Messrs. Scribner and Coleman, of Chicago.

The O. C. Little Pulley Coating Company, of Menasha, Wis., had its interests looked after by Mr. O. C. Little.

The Illinois Insulated Wire Company, Chicago, was represented by President Fred H. Alden.

The Columbia Incandescent Lamp Company, St. Louis, was represented by the manager of its Northwestern branch at Minneapolis, Mr. James B. Coale.

The Manhattan General Construction Company was represented by its Chicago manager, Mr. Frederick L. Merrill.

The National Carbon Company, Cleveland, Ohio, was represented by Mr. D. T. Wallace, of Chicago.

The Standard Carbon Company, of Cleveland, Ohio, had its interests in charge of Mr. Wallace O'Connor.

The Badt-Goltz Engineering Company was represented by Mr. William Goltz.

The Adams-Bagnall Electric Company, of Cleveland, Ohio, was well taken care of by its Chicago manager, Mr. J. G. Pomeroy.

The Illinois Maintenance Company, Chicago, was represented by its manager, Mr. H. E. Cheney.

The Robert L. McOuat Electric Company was represented by Mr. R. L. McOuat, assisted by Mr. Robert S. Givens, of Chicago.

The Buckeye Electric Company and Jandus Electric Company, of Cleveland, Ohio, had Mr. J. H. Cooke, their Chicago manager, in charge.

The Gregory Electric Company, Chicago, was well looked after by President A. O. Kuehmsted, assisted by Mr. R. H. Watson.

The Wagner Electric Company, of St. Louis, was represented by its Chicago manager, Mr. George B. Foster.

Cutter Circuit Breakers in London.

At the International Tramways and Light Railways Exhibition now being held in London, the Cutter Electrical Manufacturing Company, of Philadelphia, has made, through Robert W. Blackwell & Co., Ltd., one of the most complete exhibits of circuit breakers ever brought together for such a purpose. It includes a complete line of both single-pole and double-pole circuit breakers, of from 5 amperes capacity to 3000 amperes capacity, actual rating, these breakers being designed to operate in the event of a predetermined overload, and made for given voltages, in the case of the single-pole types at voltages of 600 and under, and in the case of double-pole types at voltages of 250 and under. There are also breakers of various capacities intended for alternating currents of 2200 volts and under, these being used almost exclusively on lighting circuits.

In addition to the straight overload, there are a number of breakers of various capacities with other functions, namely, a type intended especially for the protection of motors, which, in addition to the usual overload action, also automatically opens the circuit in the case of the current supply being cut off, this latter actuation being effected by an armature normally restrained by the magnetization of a shunt coil and released upon the cessation of line pressure.

There is also a very complete exhibit of circuit breakers intended for the protection of storage batteries, the so-called "Series Over and Underload." In addition to the usual overload function, these instruments also open the circuit between the storage battery and the generator upon a cessation of the charging current, thus preventing the reversal of the battery current into the charging line, the voltages dealt with being for the most part 500 and under.

A circuit breaker of double-pole, double-coil type is also shown, which is intended for service upon either direct or alternating current. The peculiarity of this device is that it is provided with an actuating coil on each side of the circuit, the operation of either coil being independent of that of the other. While frequently used for direct-current installations, the especial field of service for this type is polyphase work, where under very severe conditions its usefulness has frequently been demonstrated.

Circuit breakers of a single function, namely "Underload," are also shown, this type of instrument being intended for the protection of storage batteries in charging, serving to disconnect the battery upon the cessation of the charging current, thus preventing useless discharge of the battery into the charging circuit. It is almost needless to remark that the constantly-increasing demand for storage batteries is one reason for the growing popularity of this type.

It is believed that the "Internal Auxiliary Coil" type of overload circuit breaker will meet with especial attention, the function of this coil being to open the circuit breaker automatically by means of a push button located at some distant point. Or, it is frequently desirable to have two or more instruments inter-connected, so that the operation of any one will cause the opening of all of them. In the type shown, this auxiliary coil of fine wire is placed inside the main coil of the instrument.

But perhaps the instrument which will attract most attention is the latest product of the Cutter Company's laboratory, namely, the "Laminated Edgewise" type, of which two are shown—a single-pole instrument of 3000 amperes capacity and a double-pole instrument of 800 amperes capacity. These instruments embody, in addition to the well-known "I-T-E" principle, a number of important features, and have already been specified, and are now being installed, in some of the most important work recently undertaken in Great Britain and on the Continent.

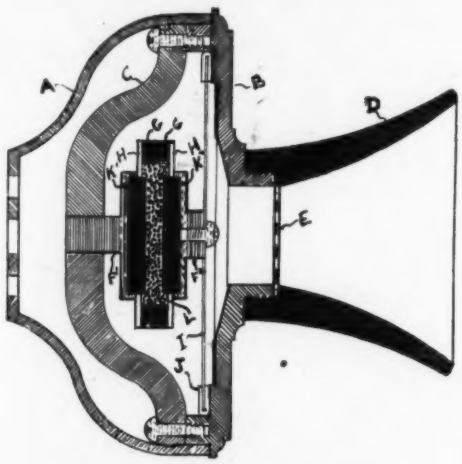
At the close of the exhibition all of these circuit breakers will be placed upon the exhibition board which it is the intention of the Cutter Company's representatives, Messrs. Robert W. Blackwell & Co., Ltd., to erect in their new quarters, 59 City Road, London, E. C., where those who are not able to visit the exhibition will have an opportunity of studying them at their leisure.

New Form of Telephone Transmitter.

The Century Telephone Construction Company, of Cleveland, which has recently entered the manufacturing end of the field, is pushing the Century transmitter, a sectional view of which is illustrated. This transmitter was shown to the public for the first time at the recent telephone convention in Cleveland, where it attracted much attention. The special features are its extreme strength, as shown by the heavy cast front, *B*, and the heavy bridge, *C*, which holds the electrodes in place, and also the heavy, pressed outside cup, *A*. It is asserted that no transmitter using a thin-pressed front and back can be made to give uniformly good service, since it is susceptible to vibrations, and the brass stamping for front and back, unless made from heavy material, which is not generally used, is certain to spring and warp and get out of adjustment.

In the transmitter shown, the parts are cast in heavy form, with the object of securing utmost solidity. A still more important feature is that it is impossible for it to pack or lose its adjustment. The company has devoted exhaustive experiments to various forms of construction in developing this point. It is stated that when a transmitter packs, it is always at the base of the granules, caused by the granules settling at the base, and particularly in transmitters that have a carbon back with a concave surface, bringing the base of the back electrode closer to the front electrode than the centre, and making less resistance at the lower surface through the particles than in the centre. The current seeking the path of the least resistance passes through the lower portion of the transmitter instead of the centre and upper portions, thus causing the granules at the base to become overworked, heated, solidified and packed.

It will be seen by glancing at the illustration, that the carbon particles fall below the carbon electrodes, *K*, and rest on the felt cushion, *G*, and between the two rings of mica, *H*; also that the two electrodes *K*, are absolutely parallel at all points. The scientific feature of the



CENTURY TELEPHONE TRANSMITTER.

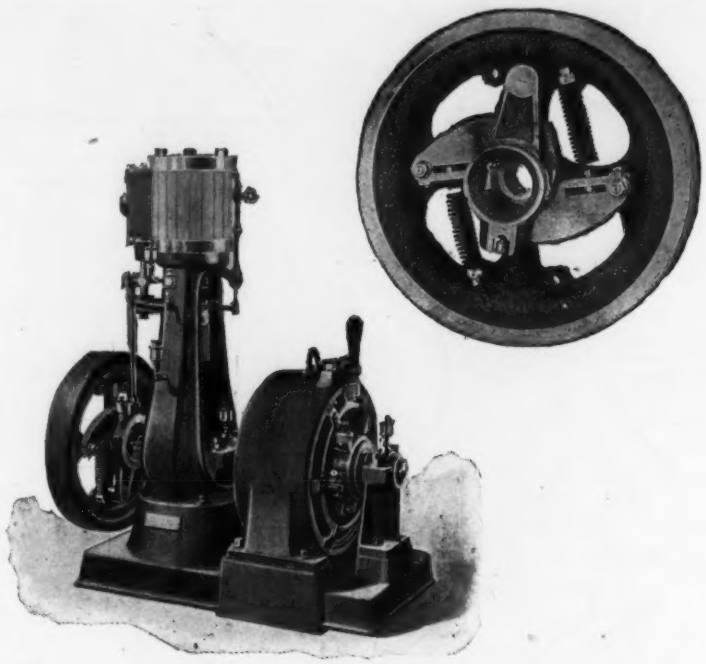
transmitter is that the portions of the carbon liable to pack are allowed to drop below the direct line of flow of the electric current, and it is claimed that if there is any solidifying and packing, it occurs ordinarily below the path of the current. Where the circuit begins to pass from one electrode to another, the lower granules will be as loose as in the centre or upper portions of the transmitter. It is claimed, therefore, that equal resistance is secured in all parts of the transmitter; no more or no less at the base than in the centre or upper portions, making it impossible for any of the granules in the circuit to pack.

It is claimed, also, that by placing the felt cushion as shown, the uncertain resistance sometimes met with through the felt cushion coming in contact with the diaphragm, is avoided. The carbon electrodes, *K*, fit closely into the brass cups, *F*, and are turned to an absolutely true surface. After being fitted into these cups, the back electrode is adjusted to the front one by means of a set screw placed in the brass casing, *C*.

Still another feature is that no metal surfaces are shown on the face of the electrodes. The diaphragm is of metal, and is insulated with a rubber ring, *J*. By taking off the cup, *A*, the transmitter is entirely open to an inspection of all its parts, making it easy to repair if necessary.

Greenfield Vertical Engine.

The two cuts accompanying this article illustrate the latest type of vertical engine made by the Greenfield Steam Engine Works, Harrison, N. J. The engine is automatic, but is built on the same gen-



FIGS. 1 AND 2.—GREENFIELD VERTICAL ENGINE.

eral plans as the throttling engine which the company has been manufacturing successfully for many years. Great care is used in the construction of these engines, the workmanship being of the best throughout, and only the highest class of materials being employed. The steam joints are scraped and ground to a perfect bearing, the piston is fitted with spring rings and the crosshead has adjustable composition gibs to take up wear. The shaft, piston rod, valve rod and crosshead pin are made of forged steel. The crank-pin box is lined with the best babbitt metal. The bearings are all extra large and long, and adjustments are provided to take up wear. They are self-oiling with a chain feed.

The governor is of the ordinary fly-wheel type, as shown by the illustration. The speed at which it is to run, or the direction of rotation may be changed in a few minutes without removing the governor from the shaft. The speed is altered by bringing the connection of the springs to the centrifugal weights nearer the shaft, perfect adjustment being secured by graduations at the sides of the slots in the weights.

All parts of the engine are interchangeable and are easy of access for adjustment or repairs. The engine is quiet running and governs well, making it especially adapted to isolated plants where floor space is an object. One of the cuts shows a 12-hp Greenfield engine direct connected to a Westinghouse dynamo. Thirteen sizes are made in all, ranging from 3 horse-power to 100 horse-power.

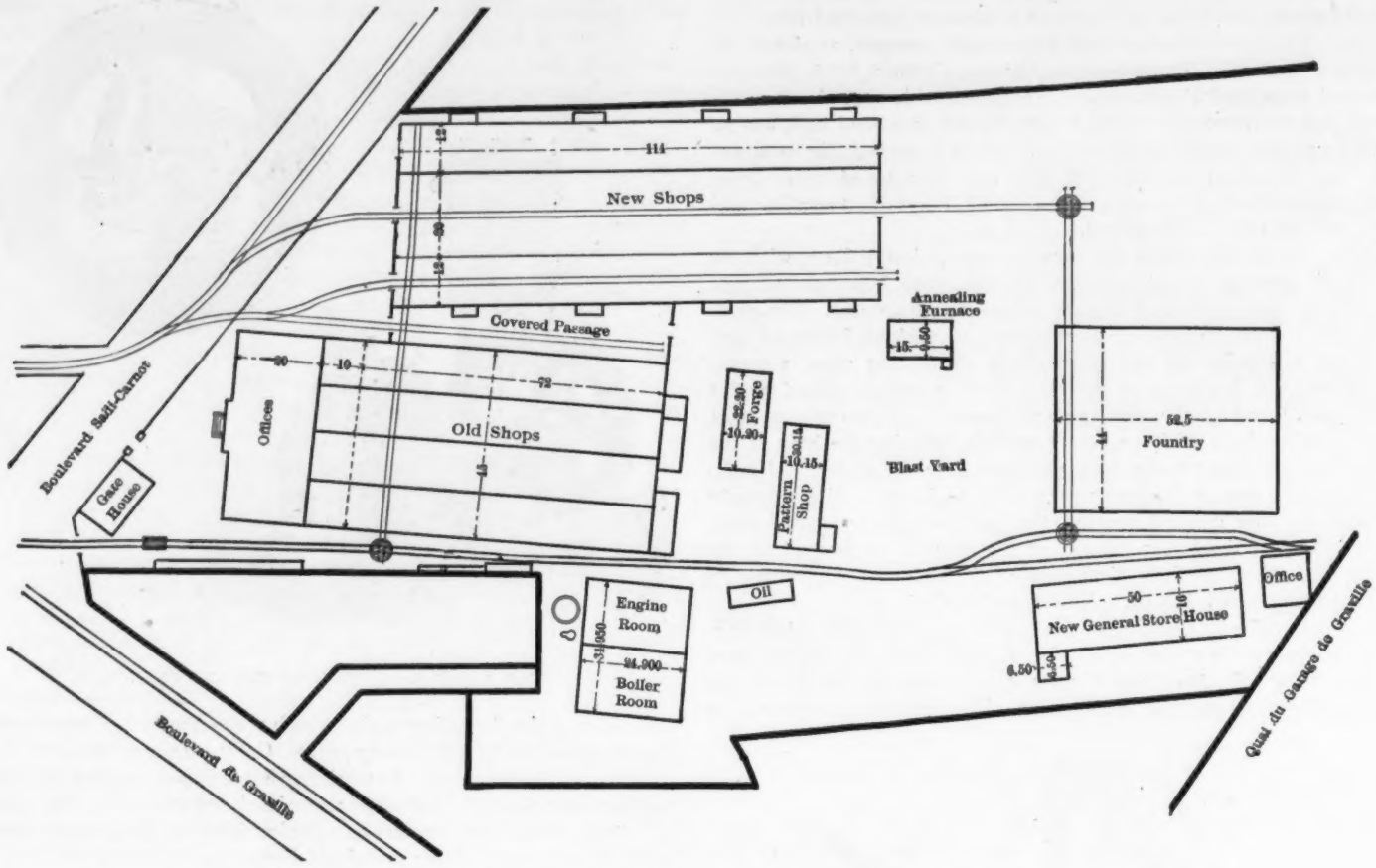
Electricity In Greece.

Cosnul McGinley, of Athens, reports that he learns from reliable sources that the Athens & Piræus Railway Company must, according to conditions in its franchise, adopt electricity as the motive power for its trains within the next three years. This road extends from the quay in Piræus to the business centre of Athens, some five miles, three-fourths of a mile of the distance being through a tunnel under a portion of the city. A Belgian company which owns and operates a steam tramway between Athens and Piræus, via Phaleron, also proposes to adopt electric power for its trains. Each road has a very large passenger traffic, especially in the summer. A company of Athens has been trying to secure the contracts for equipping these roads with electric power. The president of the first-named company has gone to the Exposition at Paris to examine the electric railway exhibits there, with a view to securing the best possible power for his road.

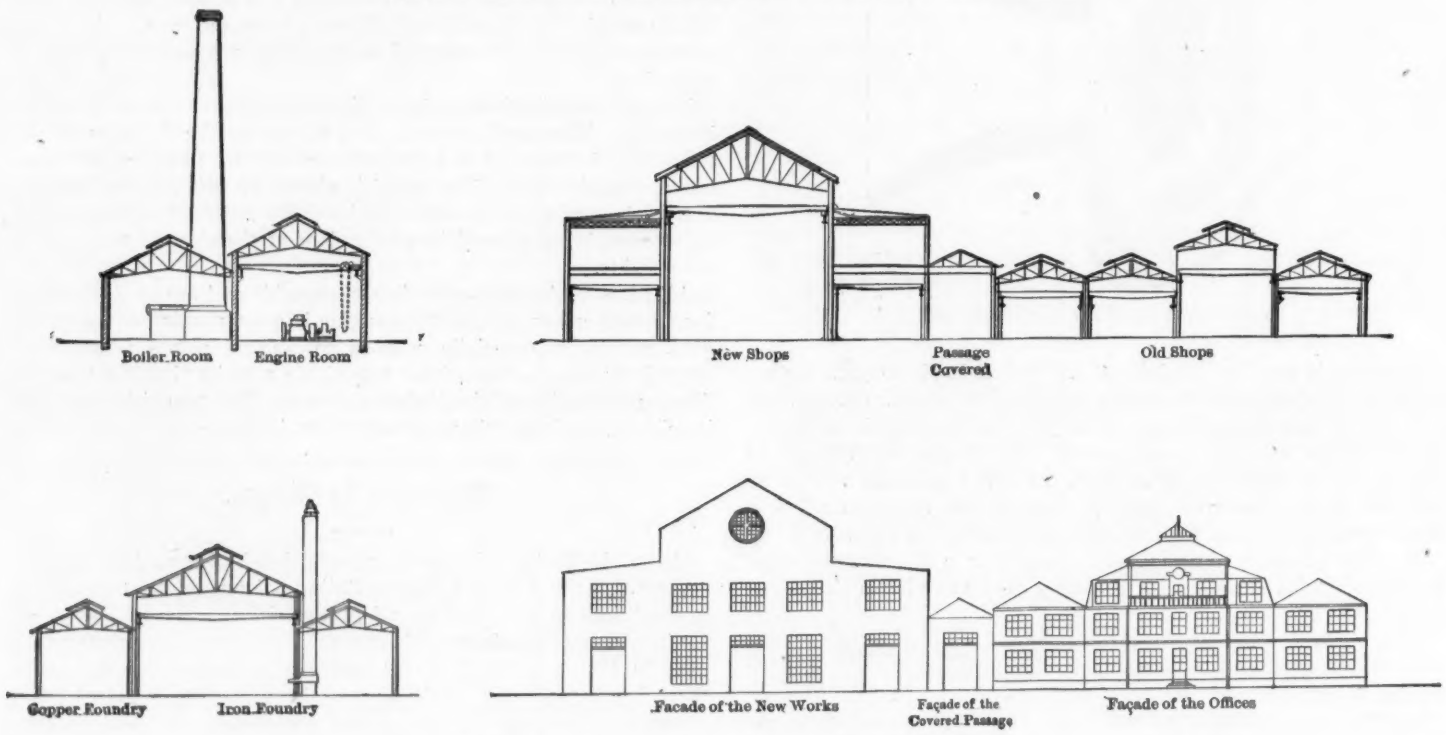
The Westinghouse Electric Factory at Havre, France.

The development of the Société Industrielle d'Electricite procédés Westinghouse has already been so rapid that this new concern has had to make extensive plans for enlarging its facilities at Havre, France, in order to catch up with the accumulation of orders and contracts now upon its books. It is not so many months since Mr. Lemuel Bannister went to France to assist in the organization of this enterprise, but it has been carried into remarkable prominence in the electrical industry of France in a manner that would betoken brilliant success for the vigorous and aggressive policy adopted, as well as a keen appreciation by purchasers of the qualities of the apparatus. Perhaps it would be hard to say just how much of the output would have gone to swell the figures of American exports, under the conditions that applied previously; but it is certain that the prompt patronage extended to the company indicates a liberal attitude of the French public to the American machinery thus made within their own borders.

At the present moment, work on the new factory trebling the capacity of the old one and giving employment to 1800 men is being pushed, and it is expected to be in full operation by January, 1901. Views are given here of some parts of the old shops, crowded with generators, street railway motors, controllers and other apparatus in all stages of forwardness. At this moment the factory can produce generators up to a size of 500 kilowatts, while the new one will be able to turn



GROUND PLAN, WESTINGHOUSE ELECTRIC FACTORY, HAVRE, FRANCE.



FRONT AND SECTIONAL VIEW, NEW HAVRE SHOPS.

out machines having a capacity of not less than 3000 kilowatts. A good many of the machines and tools used are of American origin, while those for the new sections will also be brought from the United States, purchase being made of some of those sent over for the exhibits at the Paris Exposition.

The topographical relations of the old parts of the factory and the new will be better understood from the map here shown of the buildings and the grounds. Sectional diagrams are also shown of the new shop and the factory offices, the power plant, the foundries and the general store room. The main new factory with its two bays has an extreme length of not less than 375 ft. and a width of about 150 ft., with a height for the main roof of 65 ft. For the central aisle there is an electric traveling crane of 30 tons and one of 10 tons in each side bay. As far as possible all the machines and tools will be driven by motor, direct connected or belted from shafting, and there will be a minimum of belt and shaft so as not to detract from the perfect lighting otherwise attained from the large American windows, etc., the said windows being dubbed by the French workmen "fenetres à la guillotine."

SOME OF THE DEPARTMENTS, WESTINGHOUSE FACTORY, HAVRE.

The power building, which will be in a very forward state by the time this article appears, is of considerable dimensions, being 105 ft. wide x 82 ft. deep. It will include four 400-hp French Babcock & Wilcox boilers at 150 lbs. pressure, with Worthington pumps, and the engines will be of Westinghouse make with Wheeler surface

condensers. There will be two 400-hp engines direct connected to Westinghouse three-phase generators at 3000 alternations and 250 volts; two of 400 horse-power direct connected to 500-hp, direct-current machines, and one of 200 horse-power direct connected to a 125-kw, 125-volt machine for lighting, excitation, etc. Power will be distributed, as intimated above, by the alternating current, and the big crane will be operated by the 500-volt direct current.

The managing director of the company, with headquarters at Havre, is that well-known engineer, Mr. Albert Schmid, so long associated with Westinghouse interests in this country. The "sous directeur" is Mr. Maurice Coster, who was for some time actively connected with the mechanical and commercial branches of the concern, and for a while had charge of the Westinghouse office in Chicago. Under their care, subject to such natural conditions as must prevail owing to differences of environment, the factory is a distinctively American shop, working under the best economy and efficiency obtainable either side of the Atlantic, and the management is not slow to show with pride the beautiful smoothness and finish of detail on all the apparatus produced. Mr. Schmid's staff at Havre includes the following gentlemen: E. E. Nolan, superintendent of the shops; O. C. Reymann, mechanical engineer; T. A. Cleland, general foreman; W. C. Reed, electrician; H. Hart, engineer, detail department; H. L. Kerker, engineer in charge of testing room. The business offices of the company are at 45 Rue de l'Arcade, Paris, in charge of Mr. Maurice Coster, who has the title of "Sous Directeur." The staff there is principally composed of the following gentlemen: Max Halder, Jean Welter, Joe Wolfe, Georges Petit, François Lasnier, Alexandre Hatet, Dr. B. Paladini, L. A. Philipps, Edwin Baker, R. Salberg, Herrman Borel, etc.

Twentieth Anniversary of the Edison Lamp.

Time runs away so quickly, there are many men familiar with the development of the Edison incandescent lamp to whom it will come as a surprise to be reminded that it is 20 years since Mr. Edison gave his first public demonstration at Menlo Park. In 1880 he started the first Edison lamp factory with a few men and a capacity of 100 or 200 lamps a day, and, as noted recently in these pages, two of the exhibits in the United States Court of Honor in Electricity Building are the first chandeliers ever wired for incandescent lighting and the agent's case of lamps, sockets, etc., used in soliciting for customers for the first Edison station in New York City.

It is an interesting fact that the lamp to-day contains the same elements that it contained 20 years ago, none having been added and none omitted from the lamp during this period of time; and yet each of the elements which constitute the lamp has been so changed and developed that the lamp to-day is different in every respect from the old lamp, both in appearance and performance, and also in economical construction. This last item is well illustrated by the fact that 20 years ago lamps sold at $1.00 in the same quantities for which they now sell at 20 cents, and the profit per lamp is very much more now than it was then; in fact, it is claimed, that lamps sold at $1.00 20 years ago were made at a loss.

The lamp bulb of 20 years ago was made at the lamp factory from glass tubing, being blown according to eye-gauge of size without any other guide, so that their shape could not possibly be more uniform than the skill of various operators could make them. The bulbs are now blown in a mould at the glass works, insuring uniformity of shape and size.

The filament of the lamp has changed very materially, both in appearance and in character. It was then made of bamboo, cut to the desired size by plane. This planing required eight different operations before the piece was reduced to the desired size. This was not only very expensive, requiring very accurately made tools, but even at best it was very difficult to make a filament which was as uniform in size as the requirements of the lamp demanded.

The old bamboo filaments were put into the lamps just as they came from the carbonizing furnace, so that the performance of the lamp was limited by the temperature which this piece of wood charcoal would stand. This temperature was nothing like as high as is possible with the present filament which has the graphite coating added to the filament after it comes from the furnace.

The efficiency of the lamp, which is ordinarily expressed in watts per candle, is determined by this temperature, and the difference between the old and the new may be well illustrated by the figures of 6 W.P.C. in the lamp of 20 years ago, and 3.1 W.P.C. at the present time.

This difference in efficiency does not tell the whole story, because the filament of 20 years ago was a plain loop, which, although it gave 16 candle-power in the position in which lamps are measured, yet the total light given by a 16-cp lamp then was much less than that given by a 16-cp lamp now, because the present filament being of the well-known oval form gives a much larger light in the positions other than the one in which lamps are measured than did the old one. Thus, the old loop measured through the tip of the lamp only gave 3 candles, whereas the present lamp in that position gives 7 candles.

The glass tube which supports the filament from the bottom of the lamp has been developed very considerably, although in appearance it is much the same. The tendency of the change has been to reduce the necessary amount of platinum used in the old lamp. In the old lamps probably 10 times as much platinum per lamp was used as is used to-day, and yet the platinum of to-day does its work just as well as did the old lamps with the large amount.

The base of the lamp has been improved, not only in appearance, but also in performance, as the old bases were constructed on a bad principle, which caused many of them to break in use. The last, but one of the most important elements in the lamp, which, although important, is invisible, is the vacuum. The vacuums produced 20 years ago were as good as can be produced to-day, but great improvement has been made in the methods of getting them and in their uniformity. Twenty years ago it took five or six hours to exhaust a lamp, whereas now they are exhausted in one minute; while the proportion of inferior vacuums produced 20 years ago was very much greater than it is to-day.

The improvement in methods of manufacture, which is illustrated by the great reduction in cost mentioned before, may be further illustrated by the fact that only a few years ago the cost per lamp produced of the breakage incurred in the manufacture was greater than the total cost of the lamps at the present day.

Another element in the lamp, the changes in which have been plainly evident to the eye, is the joint between the filament and the platinum leading-in wire. In Edison's early lamps this joint was made by means of a small screw clamp, the filament being squeezed into the jaws of this by a screw driver, which was a very expensive method. This was followed by a copper plated joint, the leading-in wire being folded around the end of the filament, and the whole joint being covered by copper by electro deposit.

Both these methods required that the ends of the filament be enlarged so as to cool the filament before it came in contact with the metal. This required greater accuracy in the cutting of the filament, as, being made with enlarged ends, there was no possible variation in length after it was carbonized, and if it was made wrong originally it could not be changed.

The present filaments are made longer than they are needed, and cut to the right length after they are carbonized. This is made possible by means of a carbon joint between the filament and wire, which is not injured by the high temperature at the point where the filament leaves the joint. This carbon joint was first made by folding the leading-in wire around the filament, and heating the joint so made very hot under gasolene. The heat decomposed the gasolene and deposited a carbon covering on the joint, which made a very perfect connection.

This was superseded by the present carbon joint, which is applied in the form of a carbon paste, which, after being baked in a furnace, decomposing the hydrocarbon liquid element of the paste, forms a dry carbon joint, which is quite satisfactory.

A great deal of work has been done in the development of each of the elements of the incandescent lamp, and each evolution must be done with a knowledge and consideration of all the other elements, as a change in one element may be very good considering that element alone, but may affect the others disadvantageously. This makes a problem with several factors in it, all of which are very important, and the effect of a change in one is often very difficult to trace to the element which has caused it, as the effect often appears as far distant from the cause as is possible. The success of the Edison lamp has also been very materially aided by the system of testing and inspection employed at the factory, and by the very accurate selection of lamps, so that each lamp is shipped for use at the voltage for which it is best adapted. There are used in the factory pieces of ap-

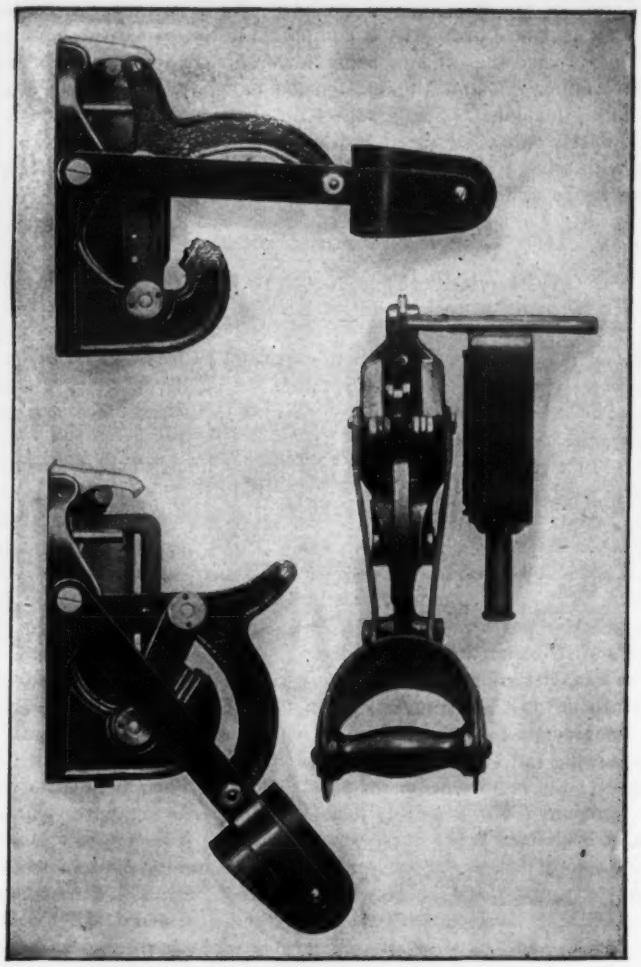
paratus which measure the diameter of the filaments to the forty-thousandth of an inch.

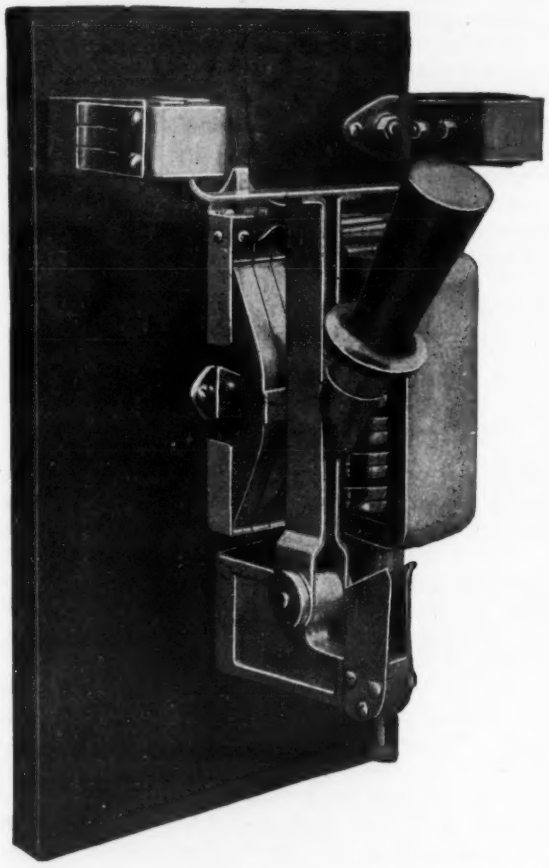
While the immediate effect of such inspections and rejections is to increase the expenses, the ultimate effect is to increase the business on account of the greater excellence of the lamps which are shipped. The result of this policy is shown in the very large increase in business during recent years. The Edison lamp factory of the General Electric Company turns out 55,000 lamps per day, or nearly 16,000,000 lamps per annum.

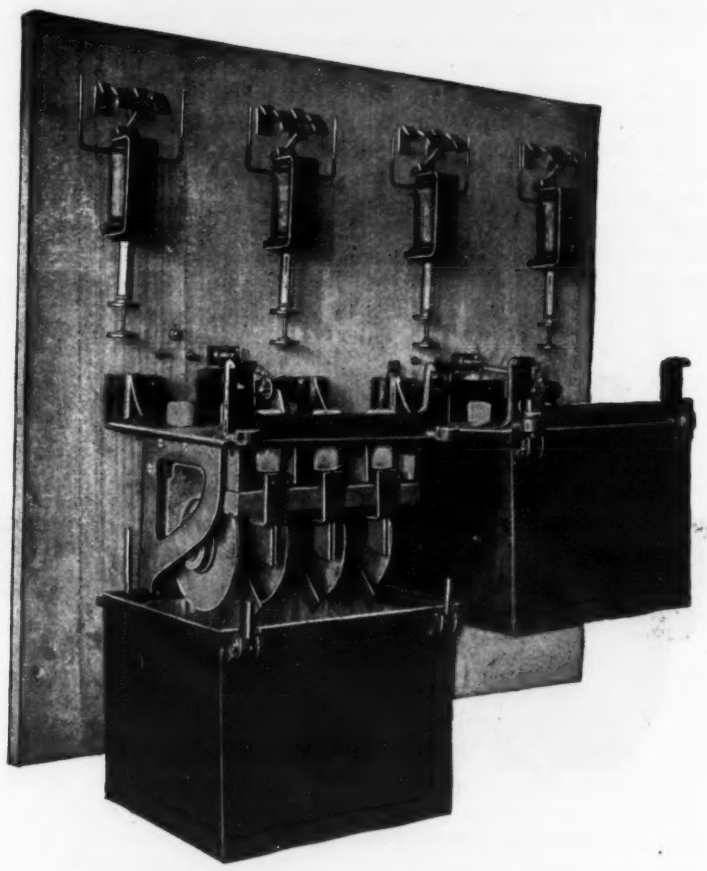
G. I. Automatic Circuit Breakers.

A new line of automatic magnetic circuit breakers has been placed on the market by the General Incandescent Arc Light Company, of which the railway and polyphase types are illustrated herewith. The magnetic portion of the circuit is of the coil and plunger type, consisting of a solenoid and a movable core of soft iron, which is raised by magnetic means against gravity, there being no springs or other means of adjustment. The contacts are of the laminated type, which are prevented from arcing by three metal shunts one opening after the other and by a final carbon break of great length. In the case of the railway type, two long, carbon breaks in series are provided on the single-pole circuit breakers. One of the advantages of this type is that the laminated contacts, tending to free themselves by opening the circuit, are at all times alive to respond to an overload, and there is no tendency to sparking. Gravity also tends at all times to open the breaker. The contact blocks upon which the laminations make connection are flat and parallel with the switchboard, so that in transferring the device from its template to the switchboard, variations make no change with respect to the contact. The laminations are calculated so that each leaf shall bear with equal pressure. The opening spring, which actuates both the laminated contacts and carbon carrier levers, operates until the carbons are free and open, thus preventing any sticking of the carbons.

In the double-pole type, each side of the circuit is independent and with separate latches; each side can thus be closed separately,







FIGS. 1, 2 AND 3.—G. I. AUTOMATIC CIRCUIT BREAKERS.

and if an overload condition exists, it is impossible to close the circuit, as the first side closed opens in the case of an overload if the second side is closed. This feature makes it unnecessary to provide the switch in series with the circuit breaker, as has usually been the case heretofore. In this circuit breaker it is not necessary for the core to deliver a blow to the latch, the steady pull of the magnetic circuit being more than enough to open the breaker. Roller latches are provided in all the circuit breakers.

In Fig. 2 is shown a circuit breaker of the oil type for high tensions and for use on polyphase systems. As illustrated, the contact of the switchboard ordinarily is equipped for two generators or feeders, in one case the oil box being lowered. The circuit is broken entirely under oil, and all high-tension parts are behind the board and highly insulated. Fig. 3 shows the throwing-in toggle arrangement placed on the front of the board. A similar arrangement is used with other types of circuit breakers of large size when it would otherwise be difficult to close the device.

Elwell-Parker Automobile Motor.

In meeting the rapidly-increasing demand for a motor adaptable for use in propelling electric automobiles, the designers of electric motors have been forced to consider several new features never before essential in small motor construction. The requirement in this direction is for a machine that is compact and of high efficiency, because of the great weight of the batteries necessary for storing the required electrical energy. Such a motor must have a high efficiency at the frequent and average loads to get the best results. It is also of first importance that it shall not require attention in oiling and adjusting, and it is also necessary that the motor shall be readily adaptable for nearly all standard forms of vehicles without material change in its construction.

The Elwell-Parker Electric Company of America, the headquarters of which are in Cleveland, has given the subject in question exhaustive consideration, and after an extended series of experiments, is now turning out standard motors for automobiles which are claimed to answer the requirements for a first-class machine, as noted above. The company's No. 2 motor, which is illustrated herewith, will deliver, it is claimed brake horse-powers in range from 1½ to 2¾ without dropping below 82 per cent efficiency, and this also within a range of speeds between 800 and 1300 r. p. m. This machine is equipped with the latest pattern of dirt and dust-proof ball bearings that are so made as to be interchangeable. There are two ball races in each of the two bearings, and they are so seated as to be self-aligning. The frame or casing is practically water-tight, and yet with suitable provision for quick inspection of adjustments at the commutator. The commutator is of a size to secure plenty of brush surface for the proper handling of large currents necessary when the machine is called upon to exert heavy torques. The field magnet is of the laminated type, with continuous wrought-iron yoke, and the field coils, with their cores, are easily removable in case of necessity. The whole design and construction is such as to secure the highest electrical and mechanical efficiency; the No. 2 motor weighs only 145 lbs., but will deliver a range of brake horse-power up to 5½ and an efficiency of 82 per cent on the wide range of power, as noted above.

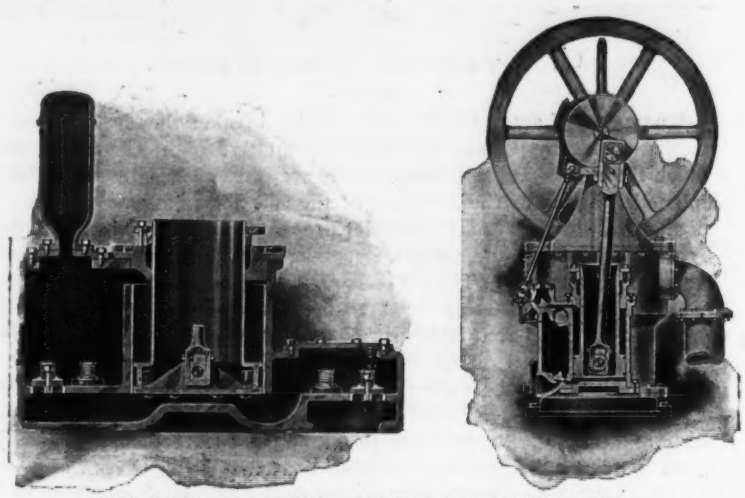
ELWELL PARKER MOTOR.

In a recent test of one of these machines, a vehicle, with passengers, weighing 1950 lbs., was propelled at a speed of 12 miles an hour with 12¾ amperes of current, and a voltage rather under 80. The test was made on asphalt pavement, which is said to be inferior to a hard, sandy road for light-running qualities.

Conover Combined Air and Circulating Pump.

The accompanying illustrations show a new combined air and circulating pump recently brought out by the Conover Manufacturing Company, New York. It is very heavy in design, and being operated by a compound Corliss condensing engine the economy naturally is of a high order.

This engine is the same as used on the Conover jet condenser, which has proved its efficiency by years of use in the numerous large



FIGS. 1 AND 2.—COMBINED AIR AND CIRCULATING PUMP.

plants both here and abroad. The air pump is the regular Conover pattern, vertical, single-acting, and is made amply large for the slowest revolutions required to give the proper amount of water through the circulating pump. The pumps are arranged to vary the speed to give the proper amount of circulating water through the surface condenser at all times, the air pump taking care of itself. The air pump, excepting for the slight difference in friction, requires practically the same power to operate it without reference to the speed. The same water and air being delivered in each case, a faster speed merely delivers a smaller quantity at each stroke, and proportionately reduces the mean effective pressure. In this arrangement there are, therefore, all the advantages of separate air and circulating pumps in a combined machine, with less work to look after them and a much higher grade of economy. The circulating pump is of the double-acting, trunk-displacement type, which gives a very steady discharge and only requires one set of suction and discharge valves.

Fig. 1 shows a cross-section of the circulating pump, and gives a clear idea of its construction. All the internal parts, including the plunger, are made of best brass. Fig. 2 shows a cross-section of the engine.

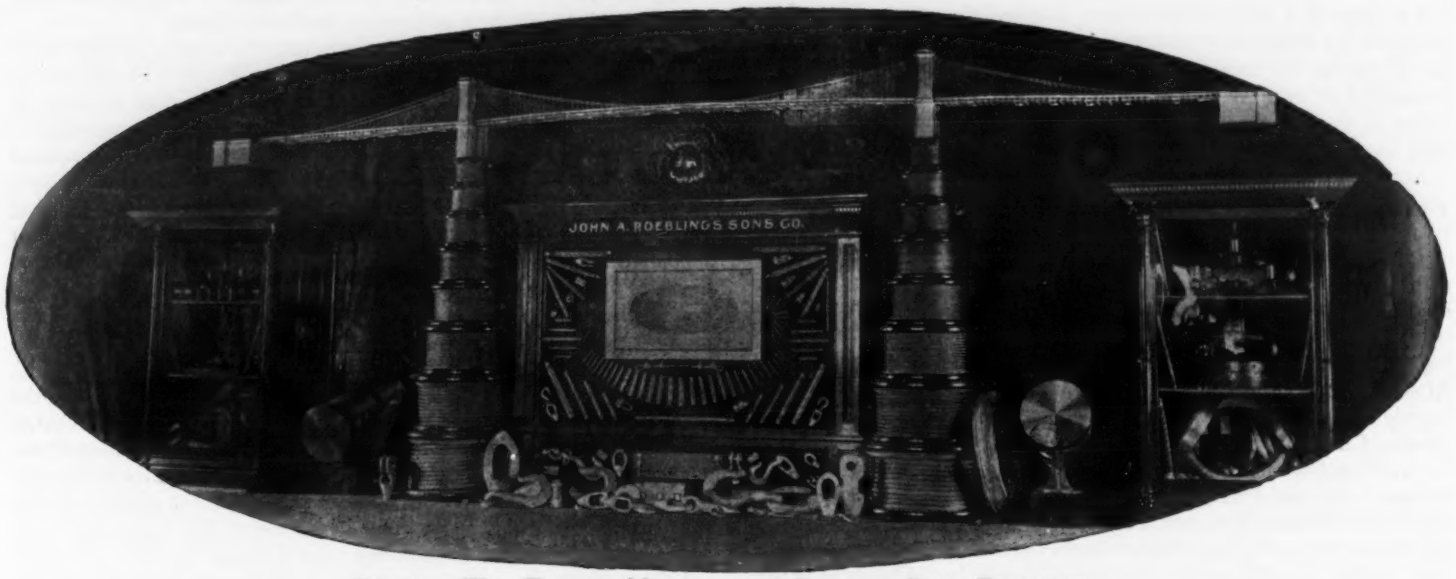
It will be seen on examination that this engine is compound condensing in one cylinder and only takes steam once for a full revolution.

Telegraphs and Railways in China.

Telegraphs and railways are among the causes of the riots now in progress in China. In a recent publication of the Treasury Bureau of Statistics, it is shown that the telegraph system of China included, in 1899, about 3000 miles of line in operation, and that the railway system included 350 miles of road in active operation and over 3000 miles projected. The telegraph system connected all of the capitals of the Provinces with the national capital, Pekin, and in turn connected with the Russian trans-Siberian telegraph line and the ocean cables; but it appears from the recent reports that those lines have in many cases been destroyed by the anti-foreign mobs and armies. What will be the effect of the hostilities on the proposed railway extensions cannot now be foretold. Among the projected lines was one surveyed in 1898 and 1899 by Mr. W. B. Parsons, chief engineer of the New York Rapid Transit Commission, under a concession granted by the Chinese government to several well-known citizens of New York. This line, like all others for which concessions have been granted, was to become the property of the Chinese government after a term of years. It was to run from Hong Cong and Canton northward to Hankow. It is stated that the American enterprise contemplated the expenditure of $20,000,000 of American money.

Roebling Exhibit of Wire and Wire Rope.

John A. Roebling's Sons Company, of Trenton, N. J., has two fine exhibits at the Paris Exposition. One of these, of electrical wires and cables, is to be found in Electricity Building, and has already been referred to in another article in this issue. By no means satisfied, however, with that exhibit, the company has made another fine display in the Mining and Metallurgical Building, which, looking from the Trocadero and the Eiffel Tower is to be seen extending a long way down the left-hand side of the Champ de Mars. In the United States section of that building the Roebling exhibit has a conspicuous space. It is chiefly devoted to wire rope and wire, and consists of a number of reels of wire roping, with two cabinets of samples of wire and rope used for a great variety of purposes. These all attract attention, but the chief item is a superb model of the Brooklyn Bridge worked out in fine detail, and standing above a centre board on which are displayed various pieces of rope and fittings. Mr. William S. Rogers is in charge of both exhibits.



ROEBLING WIRE EXHIBIT, METALLURGICAL BUILDING, PARIS EXPOSITION.

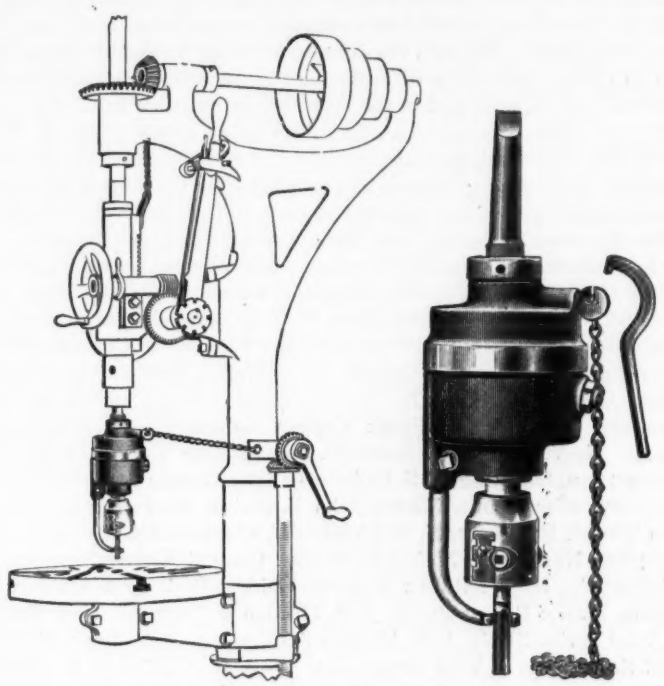
A Gaulard and Gibbs Alternating-Current Patent.

A Gaulard and Gibbs patent on alternating-current distribution by means of transformers was issued to the Westinghouse Company, June 22, the original application for the patent having been filed Oct. 26, 1886, and an application for reissue, Aug. 5, 1899. The illustration accompanying the specification shows an alternator driven from a line shaft and feeding a line circuit to which a transformer is connected. The general principle of the transformer is described, it being stated that it is analogous to that of the induction coil, with the exception that while the induction coil has heretofore usually been employed to transform energy from currents of low potential and great quantity into currents of high potential and small quantity, the invention of the secondary generator or converter, as applied in this invention, is stated to be precisely the reverse in this.

There are five claims in the patent. The first is on a method of electrical distribution and conversion employing an alternating current and producing by the influence of such a current an inductive field of alternate polarity, and thereby inducing in translating devices situated in an independent closed circuit traversing such field, a similar alternating secondary current of greater quantity and of less potential than the original current. The second claim is a transformer in which the length of that portion of the conductor traversed by the primary current within the magnetic field created by itself, exceeds the length within the same field of the conductor traversed by the secondary current, the transformer being combined with an alternator and translating devices actuated by the secondary current. The third claim is on a transformer in which the resistance of the primary exceeds the resistance of the secondary. The fourth claim is on an alternating-current generator in combination with the primary circuit of a transformer having a secondary circuit of lower potential and greater quantity than the primary, there being one or more translating devices actuated by the secondary current. The fifth claim is on a combination of a transformer having its primary and secondary circuits constantly closed, with an alternator for producing current of equal potential and duration in the primary circuit, and one or more translating devices included in the closed secondary circuit.

Improved Tapping Attachment.

We illustrate herewith the Star tapping attachment made by the Seneca Falls Manufacturing Company, of Seneca Falls, N. Y., our cut showing its actual application. It is designed to be used on an upright drill, or any machine with a revolving spindle, and requires no reverse belts. It drills or taps either bottom or through holes. It drives the tap in, stops automatically, and by simply raising the drill spindle, it backs the tap out, with a quick return, and without either reversing or stopping the machine. A complete series of operations can be carried on, such as drilling a hole, tapping it and setting a stud in, without moving the work. The principal operating mechanism consists of a clutch arrangement in connection with the spindle, and three bevel gears, the latter being used only to back the tap out. The patent positive-driving chuck is noteworthy as holding securely and accurately taps, drills, etc., driving them by their squared or flattened ends.



STAR TAPPING ATTACHMENT.

Organization of the American Bridge Company.

The American Bridge Company have issued the following circular letter to the trade: "As a result of numerous conferences, it has been deemed expedient to organize the American Bridge Company, incorporated for the purpose of designing, building and erecting bridges and all classes of metallic structures. The facilities at our disposal are such that we have every confidence that we shall be able to give you the advantage of very favorable quotations, and, at the same time, be enabled to avoid delays in delivery which in the past have proved so vexatious in many instances. We solicit your inquiries, which shall have our very best attention."

Accompanying this is a list of the various bridge companies forming the consolidation, as follows: American Bridge Works, Chicago, Ill.; Berlin Iron Bridge Company, East Berlin, Conn.; Buffalo Bridge & Iron Works, Buffalo, N. Y.; Carnegie Steel Company (Keystone plant), Pittsburg, Pa.; Edge Moor Bridge Works, Wilmington, Del.; Elmira Bridge Company, Elmira, N. Y.; Gillette-Herzog Manufacturing Company, Minneapolis, Minn.; Groton Bridge & Manufacturing Company, Groton, N. Y.; Hilton Bridge Construction Company, Albany, N. Y.; Horseheads Bridge Company, Horseheads, N. Y.; Lafayette Bridge Company, Lafayette, Ind.; Lassig Bridge & Iron Works, Chicago, Ill.; New Jersey Steel & Iron Company, Trenton, N. J.; New Columbus, Bridge Company, Columbus, Ohio; Pittsburg Bridge Company, Pittsburg, Pa.; A. & P. Roberts Company (Pencoyd Iron Works), Pencoyd, Pa.; Post & McCord, Brooklyn, N. Y.; Rochester Bridge & Iron Works, Rochester, N. Y.; Schultz Bridge & Iron Works, Pittsburg, Pa.; Shiffler Bridge & Iron Company, Pittsburg, Pa.; Union Bridge Company, Athens, Pa.; Milwaukee Bridge Company, Milwaukee, Wis.; Wrought Iron Bridge Company, Canton, Ohio; Youngstown Bridge Company, Youngstown, Ohio.

This list contains all the leading companies that manufacture bridge and structural work in this country, with the combined capacity of 600,000 tons per annum. The Pencoyd plant of the A. & P. Roberts Company, also comprises one of the best and most complete rolling mills for structural material in existence, with a capacity of 200,000 tons per annum. This puts the American Bridge Company in a position to furnish all classes of bridge and structural work at an absolute minimum of cost, and in the very shortest possible time, and this has already been announced as the future policy of the company. No advance in prices will be made, but the cost of production will be reduced to an absolute minimum, and judging from the known facilities of the various plants, the facts would seem to justify the statement.

The directors of the company are as follows: Percival Roberts, Jr., A. & P. Roberts Company (Pencoyd Iron Works), Pencoyd, Pa.; Alfred C. Case, Carnegie Steel Company, Pittsburg, Pa.; William H. McCord, Post & McCord, Brooklyn, N. Y.; Charles M. Jarvis, Berlin Iron Bridge Company, East Berlin, Conn.; William H. Connell, Edge Moor Bridge Works, Wilmington, Del.; Walter Hawxhurst, Elmira Bridge Company, Elmira, N. Y.; Charles Macdonald, Union Bridge Company, Athens, Pa.; Frank Conger, Groton Bridge Company, Groton, N. Y.; James P. Kennedy, Youngstown Bridge Company, Youngstown, Ohio; Lewis S. Gillette, Gillette-Herzog Manufacturing Company, Minneapolis, Minn.; John F. Alden, Rochester Bridge & Iron Works, Rochester, N. Y.; Walter G. Oakman, Guarantee Trust Company, New York, N. Y.; J. P. Ord, General Electric Company, Schenectady, N. Y.; Robert Winsor, Kidder, Peabody & Company, Boston, Mass.; Robert Bacon, J. P. Morgan & Company, New York, N. Y.; Charles Steele, J. P. Morgan & Company, New York, N. Y.; Paul E. De Fere, 40 Wall Street, New York, N .Y.; Robert S. Green, 1 Montgomery Street, Jersey City, N. J.; J. W. Walker, Shiffler Bridge Company, Pittsburg, Pa.; Abram S. Hewitt, Cooper, Hewitt & Company, New York, N. Y.; August Belmont, August Belmont & Company, New York, N. Y.

The majority of this board are practical bridge men who have in years past made a success of their individual companies. The financial end is unusually strong, being represented by firms and institutions of world-wide financial strength, thus forming a combination of practical and successful bridge men, backed by the strongest of financial resources.

The financial department is in charge of Mr. William H. Connell, formerly president of the Edge Moor Bridge Works, as treasurer, with F. M. Wyant, formerly general manager of the Wrought Iron Bridge Company, and F. H. Schmidt, formerly secretary and treasurer of the Youngstown Bridge Company, as assistant treasurers.

The auditor of the American Bridge Company is Mr. Charles C. Price, formerly with the Pencoyd Iron Works, of the A. & P. Roberts Company.

The purchasing department is in charge of Mr. Francis W. Heisler, formerly purchasing agent for the Edge Moor Bridge Works, with headquarters at 259 South Fourth Street, Philadelphia, Pa. The assistant purchasing agent is Mr. E. A. Muench, formerly purchasing agent for the A. & P. Roberts Company.

The secretary of the company is Mr. Douglas O. Morgan, formerly a member of the law firm of Seward, Guthrie & Steele.

The executive organization is made up entirely of men of large practical experience, headed by Percival Roberts, Jr.—one of the leading rolling mill managers of the country. The Pencoyd plant of the A. & P. Roberts Company, comprising a rolling mill with a capacity of 200,000 tons per annum and the most complete bridge and structural plant in the world, has all been developed under his personal supervision, and is the result of his energy and ability—eminently fitting him to head an enterprise of this kind. Joshua A. Hatfield has been appointed as assistant to the president, and will also have charge of the sales of the rolling mill products of the Pencoyd plant—a position for which his long and favorable connection with such work makes him especially adapted.

The engineering department is in charge of Mr. Charles C. Schneider, formerly chief engineer of the Pencoyd Iron Works, of the A. & P. Roberts Company, with the title of vice-president, in charge of engineering. Mr. Schneider has full charge of all questions of engineering, including the preparation of all plans, estimates and working drawings—all engineers of the company, whether engaged in the contracting, operating or erecting departments, are under the vice-president, in charge of engineering. At different localities throughout the country are stationed a corps of designing engineers to prepare preliminary plans and estimates, and at each plant will be located a full and complete corps of engineers and draughtsmen to prepare plans for the work fabricated at that particular plant.

The operating department is in charge of Mr. Charles M .Jarvis, formerly president of the Berlin Iron Bridge Company, with the title of vice-president, in charge of operating. As soon as contracts for any work are taken, they are immediately turned over to this department for execution, and consequently all the plants and erecting forces of the company belong in this department. At each plant is a manager, with full charge over all employees and the operations of that particular plant. Where a number of plants are closely located, they are placed under one local manager, each plant being equipped with a superintendent. All managers are under the direct charge of a general manager, Mr. James P. Kennedy, fromerly president of the Youngstown Bridge Company, who moves about among the various plants in order to see that all are working in one harmonious whole, and that each has the advantage of the experience of every other plant. The erecting is also in charge of the operating department, and this is under Mr. William Wennas, as superintendent. Mr. Wennas has had full charge of all the Pencoyd erecting for a number of years, and gained a world-wide reputation but a short time ago for the economical and expeditious manner in which he handled the erection of the famous Atbara Bridge.

All the sales of the company are in charge of the contracting department. This is divided into three distinct parts, railway contracting, highway contracting and structural contracting.

The railway contracting is in charge of Mr. Charles Macdonald, formerly president of the Union Bridge Company. The highway contracting is in charge of Mr. Frank Conger, formerly president of the Groton Bridge & Manufacturing Company, and the structural contracting is in charge of Mr. W. H. McCord, formerly of the Post & McCord Company. The preparation of all proposals and contracts is in charge of this department. The company has opened contracting offices in different parts of the country, each office reporting daily, by wire, to various members of the contracting department. The contracting department of the American Bridge Company is one of the most important,as here are made up the proposals and estimates on all work, and it might almost be said that on the careful judgment and management of the members of this department depend chiefly the success of the company.

The mechanical department has been made of equal importance with all other departments, and has been placed in charge of Mr. James Christie, formerly mechanical engineer of the Pencoyd plant, with the title of vice-president. The mechanical details of all the various plants belong to this department, and the selection of Mr. Christie as the head insures the American Bridge Company a mechanical equipment that will guarantee the production of a pound of finished bridge material at the absolute minimum expenditure of power.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was a quiet one, with much easier money conditions at the close, and with an improvement reflecting the better statements as to wheat. The disbursements in leading securities alone for dividends represent a hundred million dollars, much of which finds it way back into the market again for investment, and this has strengthened the bond market. The bank statement was a favorable one. But for the uncertainty of affairs in China, the general rally and recuperation would have gone further. So far as the relations of trade to finance are concerned, the remarkable figures of export trade only bring encouragement as to future American welfare, for the slightest lowering of prices here seems to result only in an enormous accession of exports. The results of the week's trading in the most prominent electric and traction stocks are shown below: Brooklyn Rapid Transit, net gain, 2⅞ points; General Electric, net loss, 1½ points; Western Union Tel., net gain, ¼; Metropolitan St. Ry., net gain, 1½. The following were the closing quotations: Brooklyn Rapid Transit, 54¼; General Electric, 127; Manhattan Elevated, 86¾; Metropolitan St. Ry., 146½; Third Avenue, 110; Western Union, 79¼. Outside securities: Electric Boat, 13; do., pfd., 30; Electric Vehicle, 18; do., pfd., 70; Electro-Pneumatic Transit, 2¾; General Carriage Co., 5½; Ill. Elec. Veh. Trans., 1½; New England Elec. Trans., 3⅛; N. Y. Elec. Veh. Trans., 6½; N. Y. & N. J. Telep., 160; Otis Elevator, 27; do., pfd., 88½. In Boston—American Telephone, 143; Erie Telephone, 97. In Philadelphia—Elec. Storage Battery, 77; do., pfd., 81; Phila. Traction, 96½; Union Traction, 37½; American Railways, 5¼; Brooklyn Gas & Electric, 3; Gen. Elec. Automobile, ¼; Philadelphia Electric, 3½.

TELEPHONE, TELEGRAPH & CABLE COMPANY.—President William J. Latta, of the Telephone, Telegraph & Cable Company of America has issued the following circular to stockholders: "Since the charter, your management has acquired or constructed and now controls the organizations of telephone companies in 12 States and their large cities, with plants as follows: Number of exchanges, 362; exchanges in construction, 10; number of telephones in use, 128,000; awaiting connection 17,000; miles of wire, 204,000; miles of poles, 20,000. While your company has not had the benefit of a full year's operation of the properties which it now owns or controls, the present returns indicate that the earnings will aggregate 10 per cent upon the capital invested. By resolution of the board of directors an assessment of 5 per cent, being $2.50 per share, on capital stock is now called for, payable on or before July 30, 1900. The books close on July 25 and open Aug. 2, 1900."

DIVIDENDS.—The New London, Conn., Street Railway Company has declared a regular semi-annual dividend of 2 per cent, and the Norwich, Conn., St. Ry., 1 per cent, both payable July 2 to stock of record June 27. Chicago Union Traction has declared a regular quarterly dividend of 1¼ per cent, payable July 20. The directors of the New England Electric Power Company have declared the regular semi-annual dividend of 3 per cent, payable July 16. The Michigan Telephone Company has declared a dividend of 1¼ per cent, payable July 9. The Wisconsin Telephone Company has declared a dividend of 1¾ per cent, payable July 9. The Erie Telegraph & Telephone Company has declared a dividend of 1¼ per cent, payable July 9.

ELECTRIC VEHICLE DATA.—President Lloyd, of the Electric Vehicle Company, says: "On Wednesday last our stockholders authorized an increase of stock to the extent of $3,000,000 of preferred and $3,000,000 worth of common, so that our capitalization is now $8,000,000 of common stock and $10,000,000 worth of preferred. We formerly owned a half interest in the Columbia Electric Vehicle Company, and have now issued $2,400,000 worth of preferred stock and $2,400,000 worth of common stock with which to purchase the property. Our business continues good. At this time last year we employed 400 men, whereas now we have 1700. We have orders enough on hand to keep us busy throughout this year." The Company has not declared a dividend on its preferred this quarter, but this is not cumulative.

MICHIGAN TELEPHONE.—At the annual meeting of the Michigan Telephone Company, the following board of managers was elected: Charles E. Adams, Lowell, Mass.; Frederick A. Farrar, Boston, Mass.; Frederick A. Forbes, Detroit, Mich.; Charles J. Glidden, Lowell, Mass.; William J. Latta, Philadelphia, Pa.; Martin Maloney, New York; Hugh McMillan, Detroit, Mich.; Charles S. Tuckerman, Boston, Mass.; Thomas Sherwin, Boston, Mass. The board organized by the election of Charles J. Glidden, president; Charles E. Adams, H. J. Pettengill, vice-presidents; George B. Perham, secretary; Charles A. Grant, treasurer.

Commercial Intelligence.

THE WEEK IN TRADE.—This is a time of year when trade in general is dull, except that in straw hats and straw drinks, but on the whole, there is no reason for discontent. On the contrary, bad crop reports are found to have been overdone, railroad earnings continue large and expansive, bank balances are good, and in the iron and steel trades the relations of supply and demand are becoming normal, and at a point where export trade can again be seriously pushed. The most hopeful outlook in all is the export trade as a relief to any temporary congestion, for any one who visits Europe can see with half an eye that the people there are barely supplied at all with goods which Americans long ago put in the category of the necessities of life. As to the trade, it may be pointed out that in the 11 months of the fiscal year so far reported upon, there have been witnessed such gains over the period in 1899 as $2,100,000 in the export of cars and carriages; $5,200,000 in the export of coal; $17,000,000 in copper bars and ingots; $1,900,000 in telegraphic and scientific instruments; $1,500,000 in boots and shoes; $5,800,000 in timber and lumber; $4,200,000 in tobacco, and a $25,000,000 increase in export of iron manufactures. That this could be done at a time when home consumption had pushed prices up far beyond the ordinary, must be accepted as a pretty good indication of what American manufacturers can and will do as their prices and those of the outside world come more nearly together.

EXPORTS OF ELECTRICAL MATERIAL.—The following are the exports of electrical material from the port of New York, for the week ended June 30: Antwerp—16 packages electrical material, $1,875. Argentine Republic—328 packages electrical material, $12,861; 38 packages electrical machinery, $5,136; 4 cases locomobiles, $1,200. British West Indies—10 packages electrical material, $144. Bahia—1 package electrical material, $100. British Guiana—1 case electrical material, $7. British East Indies—81 packages electrical material, $2,490; 20 cases electrical machinery, $4,259. British Poss. in Africa—2 cases automobiles, $850; 20 packages electrical material, $562. British Australia—1 package electrical material, $30. Brindisi—10 cases electrical machinery, $2,150. Brazil—269 packages electrical material, $8,437. Cuba—60 packages electrical material, $1,588. Central America—102 lbs. electrical material, $4,728. Chile—5 cases electrical material, $161. Cairo—6 packages electrical material, $105. Ecuador—67 boxes electrical material, $396. Florence—1 case electrical material, $22. Gothenburg—6 cases electrical material, $230. Glasgow—95 automobiles, $40,000; 16 cases electrical material, $859. Genoa—40 cases electrical material, $2,664. Havre—32 boxes electrical material, $5,490; 9 automobiles, $4,330; 9 boxes electrical machinery, $650. Hamburg—45 packages electrical material, $4,088; 20 cases electrical street car material, $5,300. Hull—2 cases electrical material, $250. London—13 packages electrical machinery, $1,000; 124 packages electrical material, $8,118; 63 electrical cable reels, $15,301; 13 cases electros, $112; 4 cases automobiles, $1,700. Liverpool—57 packages electrical machinery, $2,670; 31 packages electrical material, $1,084. Mexico—123 cases electrical material, $2,673. Manchester—4 cases electrical material, $650. Milan—5 packages electrical material, $168. Moscow—4 cases electrical material, $57. Nova Scotia—4 cases electrical material, $118. Newfoundland—36 cases electrical material, $1,143. Naples—47 packages electrical material, $10,935. Porto Rico—112 packages electrical material, $11,565. Peru—9 cases electrical material, $386. Rome—1 case electros, $8; 3 packages electrical material, $155. Rotterdam—2 cases electrical material, $18. Santo Domingo—2 cases electrical material, $20. Southampton—4 packages electrical material, $152; 96 packages electrical machinery, $3,394. U. S. Colombia—119 packages electrical material, $22,263. Vienna—5 cases electrical material, $156.

FORTY MILLION DOLLARS is the value of the manufactures exported from the United States in the month of May, 1900, while $25,000,000 worth of manufacturers' materials were imported into the United States. This is a higher record both in exportation of manufactures and importation of manufacturers' materials than was ever made in the history of our foreign commerce and manufactures. This assures a total exportation of manufactures in the fiscal year 1900 of fully $425,000,000, and an importation of manufacturers' materials of $300,000,000, which will make the record in both exports of manufactures and imports of manufacturers' materials much higher than that of any preceding year. On only four occasions has the importation of manufacturers' materials reached the $200,000,000 line, while in the year just ended it will be, as already indicated, about $300,000,000—an increase of 50 per cent over the average of the past five years. Exports of manufactures in 1899 were $338,000,000, and will be fully $425,000,000 in 1900—an increase of nearly or quite $90,000,000; while no earlier year ever showed an increase of as much as $50,000,000. The total importation of manufactures for the year will aggregate about $325,000,000, and, as already indicated, the total exports of manufactures will aggregate about $425,000,000. Prior to 1898 imports of manufactures always exceeded exports of manufactures. In 1888 imports of manufactures were 2½ times the amount of exports of manufactures; in 1893 they were still more than double the amount of the exports; in 1896 they were nearly 50 per cent greater than the exports, and in 1898, for the first time, the exports of manufactures were greater than the imports of manufactures, the figures for that year being, respectively: Imports of manufactures, $226,000,000; exports of manufactures, $290,000,000. Since that time exports of manufactures have steadily increased and, as above indicated, will exceed the imports of manufactures by about $100,000,000.

ELECTRICAL FREIGHT RATES.—For some time past, the National Electric Light Association has been engaged in a campaign to secure lower rates on heavy pieces of electrical apparatus. The agitation has been renewed again lately, and is attracting the attention of the newspapers, in their columns devoted to railroad news, and the matter is summed up in the following item: "The classification by the railroads of this country of electrical supplies as first-class freight is unsatisfactory to the manufacturers of such supplies. First-class freight has to pay the highest rates, and the electrical people insist that they are discriminated against. Some of the electrical appliances which are very fragile and valuable have been put into a special class, known as double first-class, and made to pay a proportionately higher rate. A movement is on foot among the electrical manufacturers to take their grievances into court, they having appealed to the railroad companies in vain for a revision of the existing classification. The contention is made by the complaining manufacturers that a large proportion of the articles for which they are required to pay first-class rates are usually shipped as third-class when used for other than electrical purposes. Even dynamos, armatures, motors and field and other castings have to pay the highest freight rates under the ruling of the railroads. It is asserted that the electrical manufacturing industry is handicapped and placed at a great disadvantage by these high rates. The railroads have been asked to make a discrimination in classification between the commonplace articles and such electrical appliances in the carrying of which there may be some risk. While the electrical manufacturers feel that they have just grounds for carrying this matter into the United States Court under the Interstate Commerce law, no definite plan of action has been determined upon as yet."

THE OTIS ELEVATOR COMPANY, of New York City, is reported to be making a great bid for Mexican and South American business. Kennerly Bryan, one of the engineers of the company, has just returned from an extended tour in Mexico, and has succeeded in securing an order from the Mexican Government for the installation of an electric passenger elevator leading to President Diaz's offices in the Palacio Nacional. Two like equipments have also been ordered for the Al Puerto de Vera Cruz. These elevators, it is said, will mark the first introduction of modern equipments into that part of the world, the last elevator—and in fact the only one at present in operation in the whole of Mexico—having been erected nearly forty years ago in one of the principal hotels in the Mexican capital. The recent South American contracts secured by the Otis Company comprise equipments for the Custom House at Valparaiso, the Obras Publicas Building in Santiago, and for the Intendencia de Santiago, Chili. Frequent shipments are also made to Buenos Ayres, the orders for the Argentine Republic coming through the New York office of the South American Electric Company. Contracts for 24 electric elevators—valued at nearly $100,000—have also just been received from the London office of the Otis people. The equipments are forwarded in the first instance to the British metropolis, from where they are distributed throughout Great Britain and various parts of Continental Europe. The company's weekly shipments to the other side are stated to average fifteen electric elevators.

VERA CRUZ TRAMWAYS.—Though no actual franchise has as yet been let for the conversion of the existing mule tramways in the city of Vera Cruz into electrical power, it may be taken for granted that the well-known English contracting firm of D. Pearson & Son—which, with Siemens & Halske, are probably the two largest foreign concerns engaged in fulfilling various important contracts in Mexico—will acquire such concession on Sir Weetman D. Pearson's return from Europe in the early fall. The contracts for the necessary material, equipment, and so forth, will be filled in the United States. The present mule track is 15 miles in length. There is also a steam tramway which will be electrically equipped. This road is five miles long, and runs to one of the principal suburbs of the Mexican city. The power-house will consist of two 300-kw generators, two 400-hp engines, and the same number of boilers of a like horse-power. On beginning operations, 15 double motor cars will be utilized. It is estimated that nearly a quarter of a million dollars will be expended before the new system is an accomplished fact. Sir Weetman has also under consideration the changing of the Terminal Railway Company's road into electric motive power. The road, which was built by D. Pearson & Son, runs from the harbor of Vera Cruz. Its length is about 14 miles.

WESTINGHOUSE IN FRANCE.—Some idea of the work pressing for the attention of the French Westinghouse Company and its a parent interests in this country may be formed from the graphic map prepared for the first edition of the New York *Times*, printed at the Paris Exposition. It showed the power-stations at Issy-les-Moulineaux, 13,500 horse-power; Vitry, 10,500 horse-power; West Paris, 3000 horse-power; the Westinghouse power plant pavilion on the Quai d'Orsay, 3500 horse-power; the moving sidewalk, 600 horse-power of motors; the third-rail road, 10 locomotive equipments; Western Railway of France, electric equipment and three electric locomotives, 2360 horse-power; the Metropolitan underground road, 46 train equipments, 9200 horse-power; various tramway systems penetrating and covering Paris, 33,000 horse-power. Some of this work has been done; much of it is still passing through the shops.

THE MORRIS ELECTRIC COMPANY, of New York City, has received an order for the supply of 400 car-wheels, which are required by the City of Mexico Tramways Company, Limited, for the extension of its operations. The wheels will be manufactured at the Ramapo Iron Works, Hillburn, N. J. A Herrington transfer table has also been requisitioned by the same Mexican road. A 14-ton electric traveling crane is about to be forwarded to the Lisbon Tramways Company, Limited. The order was sent to the Morris Company through the Portuguese Construction Company, of Bishopsgate Street, London, E. C., which concern is practically Wernher, Beit & Co., the great London financiers, who furnished the initial capital for both the Lisbon and Mexican roads. The crane will be built by the Whiting Foundry and Machine Company, of Harvey, Ill.

H. H. BARNES, JR., the chief engineer of the Compania de Mexicana Electricadad, mention of whose visit to the United States was made in last week's issue of the ELECTRICAL WORLD AND ENGINEER, has decided to purchase—subject to the formal approval of the London directors of the Mexican company—two induced-draft fans for 7000-hp boilers, from the B. F. Sturtevant Company, of Boston, Mass. He has also placed an order, under the same conditions, with the Green Fuel Economizer Company, of New York City. Mr. Barnes expects to arrange for some further purchases of mechanical equipment before he returns to the City of Mexico, on the 10th inst.

STANDARD PNEUMATIC TOOLS.—Mr. E. N. Hurley, president of this concern, has left Chicago for Europe, sailing on June 30. He goes abroad with the object of establishing works in Germany and France for the European trade. The company has large works already at Chippenham, England, but on account of the great demand for its product last year on the Continent, and the steady increase this year, it has been deemed advisable to establish these additional plants. Mr. Hurley will also visit the Paris Exposition, where the company has two large exhibits, one on the Champ de Mars and the other at Vincennes. He expects to be gone a couple of months.

THE GOUBERT MANUFACTURING COMPANY, of New York, has secured an order for feed-water heaters, which will be utilized in the extension plant of the City of Mexico Tramways Company, Limited. Substantial orders by cable are reported to have just been received from Chas. R. Heap, of 7 Victoria Street, London, E. C., for separators which are to be shipped to Liverpool, Glasgow and Lincoln electric plants. A good-sized shipment of heaters has just been forwarded to Gregory & Co., of Sydney, New South Wales.

RAILWAY MATERIAL WANTED IN GOTHENBURG.—The council of the city of Gothenburg, Sweden, has decided to build and operate the new electric railways in that place. United States Consul Berg, at Gothenburg, informs the State Department that more rolling stock and other material will be needed than at first estimated. Figge Blidberg is manager of the Gothenburg City Tramways.

General News.

THE TELEPHONE.

COLUMBUS, OHIO.—The Willoughby Telephone Company has increased its capital from $5,000 to $10,000.

PUEBLO, COLO.—The Colorado Telephone Company has increased its capitalization from $1,500,000 to $3,000,000.

COLUMBUS, OHIO.—The Cleveland Telephone Company has increased its capital from $3,000,000 to $4,000,000.

RICHMOND, VA.—The Louisa Telephone Company has been incorporated. Capital, $25,000. Incorporators: J. J. Porter, F. W. Sims, both of Louisa; F. W. Sims, attorney, Louisa.

NORTH SALEM, N. Y.—The North Salem Telephone Company has been formed. Capital, $500. Directors: H. Hobart Keeler, Earl C. Bacon, Alfred Howe and David P. Vail.

MENDEN CENTER, N. Y.—The Menden Center Telephone Company has been formed to operate telephone lines. Capital, $600. Incorporators: E. H. White, B. H. Cole, A. A. Lord, all of Menden Center.

GREENSBURG, IND.—The Decatur County Telephone Company has been formed. Capital, $30,000. Incorporators: J. Shanks, M. Spilman, J. G. Dormill, W. E. Jackson, J. S. Shaw, all of Greensburg.

BUTLER, OHIO.—The Ohio Telephone Company has closed a deal with the Central Union Company whereby the latter secures possession of 16 miles of line extending from this city to Mansfield, formerly operated by the Ohio Company.

HAMLER, OHIO.—The Hamler Telephone Company has been incorporated. Capital, $10,000. Incorporators: F. D. Quintis, W. S. Barhite, A. M. Jackson, J. I. Montgomery, O. Higgins.

NASHVILLE, TENN.—The Secretary of State has recorded the charter of the Benton County Telephone Company, capital stock $2,000, with these incorporators: G. W. Baker, H. A. Caraway, Leon Caraway, W. A. Weldon and S. W. Bullock.

ELKHART, IND.—Fitch Spencer, a capitalist of Wauseon, Ohio, has purchased the telephone exchange at Albion, this county, and the toll line from Albion to Avilla, Green Center, Cherubusco, Wawaka and Kimmel. An exchange will be put in at Churubusco.

INDIANAPOLIS, IND.—During the recent national convention at Philadelphia the Central Union & Long Distance Telephone Company supplied convention news to nearly every small town in the State, the details being sent out from this city. The trained operators have been complimented on the excellent service furnished.

INDIANAPOLIS, IND.—Reports to the Auditor of State from corporations which have property in Indiana, show that the number of telephone companies has materially increased, and the corporate property of the companies is in good condition. The State Board of Tax Commissioners began the assessing of corporate property for taxation July 1.

NEWPORT NEWS, VA.—N. C. Watts, of Staunton, one of the promoters of the Long Distance Telephone Company of Virginia, newly organized, is making arrangements to begin work on the line between Newport News and Richmond. Work will commence simultaneously in all parts of the State, and about 70 independent lines will be connected. Work will commence at this end in two weeks.

GUTHRIE, O. T.—The territorial secretary has issued a charter to the Guthrie Telephone Company. The capital stock is $9,000. It is the purpose of the company to build and operate a telephone system in connection with the Arkansas Valley Telephone Company. The incorporators are A. G. C. Bierer, Jos. W. McNeal, B. S. McGuire, Frank Dale, all of Guthrie, and John W. Noble, of Perry.

NEW YORK, N. Y.—The New York Telephone, Telegraph & Cable Company, which recently acquired control of the independent telephone lines in Westchester County, has given a contract to A. S. Deveaugh, of New York, to rebuild and repair the entire system at a cost of about $30,000. The company will also build exchanges in Yonkers, White Plains and a number of other places where it has franchises, and expects to have 125 miles of wire in operation in the county by Dec. 1.

SALISBURY, MD.—The county commissioners have granted U. H. Painter, of Washington, D. C., who is representing a syndicate, permission to erect poles along the county roads from the limit of the county on the Somerset side to Delmar, Del., for the erection of a telegraph line. All the counties below have granted the privilege, and it is said the company will build a line in opposition to the Western Union from Norfolk to New York, cabling the bay from Norfolk to Cape Charles.

MILWAUKEE, WIS.—E. E. Salisbury, of Chicago, is in this city installing a new call-box system for the American District Telegraph Company. The present call boxes will remain in the buildings, where they have been in use, but, in addition, subscribers are being secured for the installation of the "autophone," which combines a call box and a telephone connection with the central office of the American Company. The autophones are being placed in the cities of the country as fast as they can be manufactured, and the first installment to be placed in Milwaukee will be one of 10 boxes. It will take 1000 to equip the city, however. The new call boxes are 6 ins. in diameter and 3 ins. deep, and have a transmitter and receiver like an ordinary telephone. When the receiver is taken off the hook, however, a tape at the central office is marked with the number of the sending station, and an operator answers the call, as in the telephone system. It is possible, then, for the subscriber to tell central what service is desired, saving the time taken by the messenger to go from central office to the subscriber's office.

ELECTRIC LIGHT AND POWER.

ADAIRSVILLE, KY., will build an electric light plant.

ALTOONA, PA.—The Lebanon County Electric Light, Heat & Power Company has been formed, with $25,000 capital.

LAWRENCEBURG, IND.—This city has contracted for a new electric light plant, to cost $35,000. Greendale, a suburb, will also be lighted.

PRINCETON, IND.—The Princeton Light & Power Company has increased its capital stock to $75,000, and the plant will be enlarged and improved.

WINSTON, N. C.—The Wachovia Mills Company, of Winston, N. C., recently organized, with a capital stock of $20,000, will operate its flour mill by electricity.

MARION, IND.—Contract has been let by the administration of the Soldiers' Home for an electric light plant, to cost $25,000, and to be completed by the first of the year.

MUNCIE, IND.—The Crampton canning factory, a new and large concern, has begun operations. The entire machinery for the plant will be driven by electric power.

COLLINWOOD, OHIO.—The Chase Engineering Company, of Detroit, has secured a contract for the erection and equipment of a municipal lighting plant for this place.

CARROLL, IA.—The Carroll Electric Light & Power Company has filed amended articles of incorporation, changing the amount of capital stock from $5,000 to $15,000.

FREDERICKSBURG, VA.—Bids for erecting an electric light plant for lighting the city were opened. The lowest bidder was W. D. Marrow, of Richmond, Va., at $11,384.56.

PHILADELPHIA, PA.—The directors of the Easton Consolidated Electric Company declared a dividend of 35 cents a share, which is equivalent to 7 per cent per annum, payable July 23.

EAST CHICAGO, IND.—C. D. Davidson has been appointed receiver of the East Chicago Electric Light Company pending a suit to set aside the transfer to the Lake County Light Company.

COLUMBIA, S. C.—The Bell Telephone Company at Columbia, S. C., is expending in the neighborhood of $20,000 on its new plant in this city. The system will be in operation about Sept. 1.

KENTON, OHIO.—As a result of a controversy between the city and the Kenton Gas & Electric Company over the price of street light, the company last week shut the lights off and the city is still in darkness.

AMITYVILLE, L. I.—The new 1200-light dynamo recently purchased by the Amityville Electric Light Company is now in use. The dynamo formerly used, a 600-light machine, is to be kept in position in case of an emergency.

MIDDLETOWN, N. Y.—The Neversink Light & Power Company has been formed to manufacture electricity and gas for light, heat and power. Capital, $100,000. Incorporators: P. A. Rorty, W. J. Burke, H. C. McBrair, all of Middletown.

COLORADO CITY, COLO.—The Colorado City Electric Light & Power Company has been formed to furnish electric light. Capital, $10,000. Incorporators: C. M. Sherman, C. L. Cunningham, C. E. Corcoran, M. Drake, J. R. Watt, all of Colorado City.

STATESVILLE, N. C.—W. M. Cooper, of Statesville, N. C., and T. H. Vanderford, of Salisbury, N. C., have secured an option on part of the Buffalo shoals water-power on the Catawba River. The future plans of the owners are not yet made public.

HARRISBURG, PA.—The Electric Light & Heat Company, Old Forge, has been incorporated to furnish light, heat and power. Capital, $10,000. Incorporators: T. B. Jones, T. Pickrell, J. Surber, all of Old Forge; I. F. Price, of Moosic, Pa.; W. H. Nalor, of Duryea, Pa.

MASONTOWN, PA.—The Masontown Electric Light, Heat & Power Company has been incorporated. Capital, $10,000. Incorporators: C. K. Hartley, W. G. Blackshere, both of Masontown; C. A. Hartley, of Ceylon, Pa.; T. L. Collier, R. W. Playford, all of Uniontown.

PRINCETON, IND.—The Princeton Light & Power Company has increased its capital stock to $75,000, and the plant will be enlarged and improved. A heating system supplied by the exhaust steam of the lighting plant will be extended throughout the city. R. N. Parrott is superintendent.

WABASH, IND.—The First National Bank of New York has purchased the stock of the Wabash Electric Light Company, which is operating a $40,000 plant. The selling price of the stock is about $40,000. A new building will be erected, new machinery placed and the present lighting capacity will be doubled.

CEMENTON, PA.—The Cementon Electric Light & Power Company has been formed to furnish light, heat and power. Capital, $10,000. Incorporators: J. S. Wentz, of Mauch Chunk; G. D. M. Creary, W. B. Whitney, both of Philadelphia; A. C. Leiseming, of Upper Lehigh; T. M. Righter, of Mt. Carmel.

FAYETTEVILLE, N. C.—The survey party of the Cape Fear Electric Power Company, Fayetteville, N. C., consisting of Robert Strange, Lieutenant Howard and others, has about completed the survey from Fayetteville to the Buckhorn shoals, 34 miles distant, whence the company proposes to transmit electric power to Fayetteville.

WASHINGTON, D. C.—Upon the recommendation of the electrical engineer the commissioners will accept the bid of the Welsbach Street Lighting Company of America for furnishing Welsbach or other high candle-power lights of a higher candle-power than the ordinary 5-ft., flat flame gas burner, for the fiscal year ending June 30, 1901, at $30 a lamp per annum.

NEWARK, N. J.—The New Jersey Electric Light & Power Company will have its office in 800 Broad Street, Newark, and do the business indicated in its title on a capital stock of $100,000, of which $1,500 is paid up. The incor-

porators are William Hanna, of East Newark, and Adam H. Groel and Edward Kenny, of Newark.

ALBANY, N. Y.—The Yates Electric Light & Power Company, of Yates County, with a capital of $300,000, has been incorporated. The company will supply electricity for producing light, heat and power for the village of Penn Yan and towns of Jerusalem, Milo and Benton. The directors are Henry B. Pierce, Walter Cox, Henry T. Howell, Frederick T. Delafield, Frederick W. Longfellow, of New York City, and Cassius L. Haskell, of West New Brighton.

THE ELECTRIC RAILWAY.

COLUMBUS, OHIO.—The Columbus, Clintonville & Worthington Electric Railway Company has selected a site at Flint, for a power house for its Delaware line now being built.

NEW YORK, N. Y.—Award has been made by the executive committee of the Manhattan Elevated Railroad Company to M. Reed & Company of the contract for the masonry work of the new central power house, at Seventy-fourth Street and East River. The contract involves about $500,000.

LOCKPORT, N. Y.—The Lockport & Olcott Railway, which is to operate an electric road 18 miles long on a private right of way from Lockport to Olcott on Lake Ontario, has received the approval of the State Board of Railroad Commissioners of a proposed issue of a first mortgage for $1,000,000.

GREENFIELD, IND.—Previous to opening the Indianapolis & Greenfield Electric Line to the public, the management gave the people of this city a free excursion. It appeared that half the population went car riding. The line is now operating on schedule time between this city and Indianapolis.

DAYTON, OHIO.—Residents of Greene and Clinton counties have made an offer to the Dayton & Xenia Traction Company to extend its line from Xenia to Wilmington, via Spring Valley and New Burlington. The extension would open up a new country, and it is probable that the offer will be accepted.

CLEVELAND, OHIO.—The city authorities and citizens in general are up in arms because of the adopted practice by the Interurban of unloading milk, other freight and baggage in the city streets, thereby causing frequent delays to city cars. The Cleveland & Eastern Electric Railway is building a freight depot, and the city will adopt measures to force the other companies to take similar steps.

LA PORTE, IND.—It is given out that the filing of the articles of incorporation of the La Porte & Michigan City Railroad Company will be followed by the immediate construction of the electric railway between the two towns. Chicago capitalists are said to be heavily interested in the project. The corporation is looked on here as the successor to the franchise rights of the Northern Traction Company.

SCHENECTADY, N. Y.—At the first meeting of the stockholders of the United Traction Company, of Albany, the following board of directors for the ensuing year was elected: Robt. C. Pruyn, Francis N. Mann, Jr., Anthony N. Brady, Wm. Kemp, A. Bleecker, Charles Cleminshaw, John G. Myers, Edward Murphy, Jr., Simon W. Rosendale, William Shaw, John W. McNamara, James O'Neil, James H. Manning, William J. Walker, George P. Ide.

SCOTTDALE, W. VA.—A charter has been issued to the Fairmount & Suburban Railway Company to begin at Scottdale, Marion County, run thence by the most practical route to and through Fairmount, thence to Monongah and other points in Marion, Monongalia and Harrison counties, West Virginia. The capital is $1,000,000, and is held by James M. Bailey, Pittsburg, Pa.; B. K. McMechan, John A. Howard and James P. Adams, Wheeling; S. L. Watson, C. Powell and Charles E. Manley, Fairmount.

INDIANAPOLIS, IND.—At the suggestion of the Commercial Club the city officials have consulted the street railway company's franchise in an effort to find authority to require a change from the overhead system to an underground electric system. The city authorities announce that they have no power to require the change, even in the down-town districts. Other legal authority say the board of public works and City Council may direct the change; but it is generally conceded that the franchise leaves all such changes at the option of the company.

COLUMBUS, OHIO.—A resolution was adopted by the board of public works a few days ago, declaring void the franchises held by the Columbus Railway Company as successor to the Columbus & Westerville Electric Railway Company. The original franchises covering a number of important streets were granted in 1894, and, although the time limit has been repeatedly extended, the roads were never built. The company is now very anxious to build one of the roads to give connection to an interurban road. It seems probable that the company will lose the franchises.

WABASH, IND.—There are encouraging prospects for the construction of electric interurban lines between Wabash and Huntington, and between Wabash, Kokomo and Rochester. F. C. Boyd, the promoter of the former line, and who represents Connecticut capital, has gone over the route and is gratified with prospects. This township voted a $20,000 subsidy for a line to Peru, but the Peru Council refused to grant Boyd a franchise. The latter railway company, composed of Ohio, Wabash and Rochester men, will soon file articles of association and will build a line from Kokomo to Rochester. The right of way has been secured, and negotiations are now on for financing the road. Franchises have been granted through a dozen or more towns on the line, and the promoters say the road is a sure go. Its length will be 60 miles.

OBITUARY.

EMILE C. GEYELIN, the builder of the Niagara turbines, and a widely-known engineer, died at his home, 4227 Chestnut Street, Philadelphia, June 25, after a brief illness, aged 76 years. Mr. Geyelin came from an old Huguenot family, which for centuries was prominent politically at Mullhouse, France, where he was born in 1825. After graduating from l'Ecole Centrale, and studying some years in England, he came to this country. He was associated for a time with I. P. Morris & Sons, but most of his life was devoted to the invention of useful machinery. The Jonval duplex turbine was his most successful invention. He leaves one child, H. Laussat Geyelin, a member of the Philadelphia bar.

PERSONAL.

MR. THEODORE A. WILLARD, of the firm of Sipe & Sigler, Cleveland, was married recently to Miss Kathryn Edna Craven, a popular Cleveland young lady.

DR. THOMAS ADDISON, Pacific Coast district manager for the General Electric Company, has returned from a three months' tour of Europe and the Eastern States.

MR. C. L. MAGEE, the president of the Pittsburg Consolidated Traction Company, has returned from Philadelphia, where he has been staying for several months under the care of a medical specialist. Mr. Magee has now much improved in health, and he will stay home for several weeks before seeking a change.

MR. HARVEY R. STUART, of the Westinghouse Electric & Manufacturing Company, was married June 29, at Binghamton, N. Y., to Miss Ruth McNett, daughter of Mr. and Mrs. A. W. McNett, of that city. Miss McNett is the great-granddaughter of Capt. Samuel McNett, a hero of the Revolutionary War, and she is also a grandniece of Gen. A. J. McNett, who served with distinction in the Civil War.

NEW INDUSTRIAL COMPANIES.

POUGHKEEPSIE, N. Y.—The Galaxy Car Company, of Poughkeepsie, has been formed to manufacture and lease passenger and freight cars used on electric and steam railroads. Capital, $5,000. Directors: E. C. M. Rand, New York City; James L. Williams, and Frank Hasbrouck, Poughkeepsie.

AKRON, OHIO.—The Akron Electrical Manufacturing Company has been formed for dealing in electrical apparatus. Capital, $200,000. Incorporators: E. E. Andrews, L. C. Miles, J. M. McGregor, W. Christy, W. C. Hall, all of Akron, Ohio; D. A. Doyle, attorney, Arkon, Ohio.

SYRACUSE, N. Y.—The Myers' Break Finder Company has been formed to manufacture the Myers break finders and electrical inventions. Capital, $100,000. Incorporators: M. J. Myers, M. Jarvis Myers, A. C. Stevens, all of Syracuse.

Trade Notes.

THE LAWTON-BEATTIE COMPANY, Cincinnati, Ohio, will install a lighting plant in the factory of J. F. Dietz, in that city. The firm will double its warehouse and factory capacity.

THE R. H. SIMON SILK COMPANY, Hoboken, N. J., has ordered a 100-kw generator, together with eight or ten motors of various sizes, of the Triumph Electric Company, Cincinnati, for its large manufacturing plant.

THE COAL MINING COMPANY, Hollister, Ohio, has ordered of the Triumph Electric Company, Cincinnati, an 80-hp motor. The same company has an order for a 62½-kw, direct-connected generator for one of the largest office buildings in Cleveland, Ohio.

SCREW-THREAD TOOLS.—Catalogue No. 13 of the J. M. Carpenter Tap & Die Company, Pawtucket, R. I., is enlarged to 112 pages, which space is necessary to illustrate and describe the full lines of carpenter tools for cutting screw-threads, including caps, dies, screw plates, die stocks, cap wrenches, etc.

THE PAYNE COMPANY is rapidly recovering from the effects of the fire which partially destroyed its works at Elmira a short time ago. It is at present running about three-fourths of its old force and expects within 60 days to be in full operation again.

MORRIS ARC LAMP COMPANY.—Mr. George E. Darlington has been appointed receiver of the Morris Arc Lamp Company, of Media, Pa. A meeting will be held July 11, at Media, for the purpose of final settlement of the affairs of the company.

THE AMERICAN ELECTRIC FUSE COMPANY, Chicago, Ill., is now engaged in the manufacture of pins, brackets, cross-arms and other construction material. The company is still improving its standard line of fuses, fuse blocks, fuse links, lightning arresters, wire connectors and magnet wire.

THE LUNKENHEIMER COMPANY, Cincinnati, Ohio, has added an automobile manufacturing branch to its business. The plans for the automobile which will be put on the market have all been drawn and finished for some time and the patterns are now being made. The vehicle will be of the gasolene type.

G. A. CROSBY & COMPANY, 2833 Archer Avenue, Chicago, issue a large red card devoted to their punches. They own and operate the E. S. Stiles Press Company plant, formerly of Watertown, N. Y. The presses shown are in six sizes, 600 lbs. to 7200 lbs., upright, and 350 lbs. to 5100 lbs., six sizes, adjustably inclined.

THE VILTER MANUFACTURING COMPANY, Milwaukee, Wis., builder of refrigerating and ice-making machinery and Corliss engines, has recently closed contracts for 10 Corliss engines to go to various parts of the country. The company has also closed contracts for five refrigerating and ice plants, three of which are to go to Mexico and Japan.

ELECTRIC SPRINKLING CARS.—The J. G. Brill Company, Philadelphia, Pa., has recently issued a pamphlet describing and illustrating Brill Standard sprinkling cars for electric railway lines. The argument in favor of the use of these cars is a good one and should be well weighed by street railway managers in connection with the dust problem along their lines.

LAMP BASES.—The Bryant Electric Company, Bridgeport, Conn., issues an admirable brochure with the above title. It is illustrated in fac-simile colors, and gives dimensions for each base, with size of package, list number and code word. The brochure fits neatly an oblong leather cover, stamped in gold—altogether an excellent and effective piece of advertising literature.

JEFFREY PICNIC.—Two thousand employees of the Jeffrey Manufacturing Company, Columbus, Ohio, and their families were given the sixteenth annual picnic a couple of weeks ago. A most delightful outing was enjoyed by all. The officers of the company were present, including President J. A. Jeffrey, Vice-President Hutchins, Secretary Miller and Assistant General Manager R. H. Jeffrey; also their families.

PARAGON FANS AND MOTORS.—Bulletin No. 62 of the Paragon Fan & Motor Company, 572 First Avenue, New York, describes and illustrates the several types of Paragon desk, bracket and ceiling fans of 1900 models. One feature in the manufacture of these fans to which the bulletin directs particular attention is the system of rigid tests to which they are subject before approved for delivery.

EMERSON WEEKLY STOCK REPORT.—The Emerson Electric Manufacturing Company, St. Louis, is issuing weekly a report showing the stock of Emerson desk and ceiling fans on hand in its New York warehouse. The report also shows the quantities and kinds of motors on the road from the factory, together with the date they were shipped from St. Louis, and the date they may be expected to arrive in New York City.

HARRISON PRIMARY CELL.—Improvements have been made during the past year in the Harrison primary open-circuit cell, which are claimed to have greatly increased its efficiency. The e. m. f. of the improved cell when new is 2.6 volts, with a current of 25 amperes, and it has a capacity of 40 ampere-hours. The negative element is lead peroxide and the positive element self-amalgamating zinc. It is claimed that there is absolutely no local action or creeping salts.

THE AMERICAN PULLEY COMPANY, of Philadelphia, announces that in order to meet the demands for its all wrought steel pulleys it has erected a large plant at Twenty-ninth and Bristol streets. The new shops cover several acres of land. Special machinery for making pulleys up to and including 42 ins. in diameter is now in process of construction and will be put in operation at the earliest date possible. It is expected that the company will be able to fill orders for large pulleys about Sept. 1.

NILES, OHIO.—William G. Hurlburt, receiver for the Niles Electric Company, sold the company's plant at auction sale recently. E. A. Wilson's offer of $7,500 was the highest made, and it was accepted. It is stated that Dr. Minor, of Warren, and Charles Cartwright, of Cleveland, are interested in the purchase, and it is reported that the plant will continue to be operated. The sale by the receiver was made to satisfy claims held by A. A. Anderson, of Youngstown; the First National Bank of Niles and W. H. Smiley, of Niles.

MESSRS. CHARLES H. BESLY & Company, Chicago, report that their general business has been very good. They are daily making large shipments of Helmet Oil and Bonanza cups to the agricultural district, and note especial demands from California and vicinity. Their specialties are largely called for by foreign buyers, recent shipments having been made to Japan, England, South America, Germany and Mexico. They are receiving numerous requests for prices, catalogues, etc., for new shop equipment, which they consider a good indication for future orders.

THE AULTMAN COMPANY, Canton, Ohio, reports a most prosperous season, with large orders ahead. Among the more recent demands for its products may be mentioned orders for sand-handling systems, rock crushers, refuse carriers, elevators, conveyors, etc., which have been received from various States, including Michigan, Kentucky, Pennsylvania and New York. It is also installing a complete plant for the manufacture of tile and building block for the Beatty Fire Clay Company, of Magnolia, and six ingot charging machines for the Wellman-Seaver Engineering Company, of Cleveland.

NEW YORK CENTRAL LITERATURE.—The New York Central & Hudson River Railroad is doing its best to rob the hot weather of its terrors for the benefit of those who are trying to determine where to spend their vacations. The railroad company has helped these in recently bringing out three numbers of its "Four-track Series." One of these booklets (No. 6) is entitled "In the Adirondack Mountains;" the second (No. 10) is entitled "The Thousand Islands," and the third (No. 8), "Two to Fifteen Days' Pleasure Tours." All of these booklets contain valuable information to tourists and attractive illustrations, together with maps, etc.

GENERAL ELECTRIC TRADE LITERATURE.—The last literature from the press of the General Electric Company consists of three bulletins relating to the Thomson recording wattmeter for street railway service; air blast transformers, and direct-driven, continuous-current generators for lighting and power. The bulletins are gotten up in the company's standard style, and contain illustrations of the devices and apparatus treated of. The company has also issued a couple of leaflets on pendant push-button switches and sockets and receptacles for lamps with T.-H. bases; also a 32-page catalogue and price list of sockets and receptacles.

BOWSHER BALANCING WAYS.—The Georgia Iron Works, Augusta, Ga., purchased one of the Bowsher balancing ways a year or so ago. Being so unfortunate as to burn out, when the new shop was rebuilt they ordered another of these useful tools among the first material for which requisition was made. Many of the larger machine shops have also ordered their second and third tool. Such business as this indicates something of the merit in this tool, which the Bowsher Company is ready to send to any part of the country with full confidence that it will be found among the most satisfactory and profitable investments made about the plant.

THE PELTON ENGINEERING COMPANY, Cleveland, Ohio, has embarked in the machine tool business as sales agent and dealer in new and second-hand machine tools. Mr. E. F. Bosworth, formerly in charge of the machinery department of the Patterson Supply Company, Cleveland, has associated himself with the company and will have charge of the machinery end of the business. A bargain list of new and second-hand machine tools has just been issued, describing a large number of lathes, planers, shapers, milling machines, drill presses, boring mills, hammers and other tools; also a number of bargains in motors, generators, engines, etc. Also an extended list of arc lamps.

ELECTRICALLY-DRIVEN PUMPS.—The Prindle Engineering Company, 120 Liberty Street, New York, has just issued two bulletins illustrating the Prindle pump electrically-driven for general supply and house service. For house tank work, these pumps will automatically maintain a constant water level in the tank. The special advantages of the pumps are entire absence of noise and vibration both in pipe lines and machinery, small floor space required, durability and simplicity. They may be driven by direct or alternating-current motors, steam, gas or gasolene engines, or belted from any motive power. One of the catalogues contains dimensions and capacities of the various sizes and pumps.

GISHOLT TOOLS.—One of the handsomest machine tool catalogues ever issued from the press is that of the Gisholt Machine Company, Madison, Wis., which has just appeared. All of the various types of the Gisholt machine tools are illustrated by excellently-executed half-tones. In addition, many half-tone illustrations of details appear, some showing top views of machines fitted with special tools, and others illustrating single parts of the machine. The final pages are occupied by views of the works, offices, etc. That the Gisholt Works are organized on the latest modern ideas is made evident from the views given of various rooms for the convenience of the employees; one of these is of a dining room, which will seat 500 people, and another is a large and well-fitted-up library and reading room.

THE FRANK ADAM ELECTRIC COMPANY, 904 Pine Street, St. Louis, Mo., in a circular to the trade announces the purchase by it of the switch and switchboard department of the Emerson Electric Manufacturing Company. With the business also come the skilled mechanics formerly employed by the Emerson Company. The Frank Adam Company has had some experience in the manufacture of these devices and also has a well-equipped factory, and expects to maintain the high standard of the Emerson goods. The devices will be improved from time to time to keep up with the modern ideas. The company is also sending out a discount sheet, which will apply to recent bulletins issued by the Emerson Company, and which goods will hereafter be manufactured by the Frank Adam Company.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JUNE 26, 1900.

[Compiled by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

11,835. (Reissue.) BOND FOR RAILS; G. A. Webber, Stanford, Conn. App filed Aug. 9, 1898. The bond is thickened in the middle so that its carrying capacity at that point will be equal to the capacity of either of the ends of the bond for receiving current from the rail with which it is in contact.

11,836. (Reissue.) SYSTEM OF ELECTRIC DISTRIBUTION; the Westinghouse Electric Company, of Pittsburg, Pa., and John Dixon Gibbs, London, England, for the Westinghouse Electric Company, assignee of Lucien Gaulard, deceased, and John Dixon Gibbs, assignor to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa. App. filed Oct. 26, 1886. App. for reissue filed Aug. 6, 1889. (See Current News and Notes.)

652,255. CLUSTER FIXTURE FOR INCANDESCENT LAMPS; J. F. Faries, Decatur, Ill. App. filed Oct. 21, 1899. Details of construction.

652.302. DEVICE FOR ELECTRICALLY OPERATING BULKHEAD DOORS, A. H. Thomas and F. B. Richmond, Philadelphia, Pa. App. filed May 10, 1899. The doors are opened and closed by electric motors, which are controlled from a distance.

652,309. BATTERY COMPOUND; H. Bluemenberg, Jr., New York, N. Y. App. filed Oct. 10, 1899. A battery compound composed of chloride of the metals of the alkalies or alkali-earth metals, a sulphate of aluminum and a chlorate of the metals of the alkalies or alkali-earth metals.

652,333. ELECTRIC SIGNAL; J. H. Sanor, Canton, Ohio. App. filed Oct. 19, 1899. Details.

652,360. MOTOR RHEOSTAT; J. L. Hall, Schenectady, N. Y. App. filed May 10, 1900. A motor rheostat comprising means for progressively cutting out resistance, a circuit breaker operated thereby to close a branch circuit around the resistance when the motor is cut in and a releasing device permitting the rheostat to be returned to its open position after the circuit breaker has been closed.

652,374. INCANDESCENT LAMP FOR ELECTRIC LIGHT; J. F. Sanders, Chicago, Ill. App. filed Oct. 12, 1899. The lighting element is a number of carbon rods which are brought to a state of incandescence by the passage of a current, the rods are confined above and below, between discs against which their ends abut, springs being arranged to regulate the pressure and insure good conductivity.

652,385. SECONDARY BATTERY; C. J. Coleman, Chicago, Ill. App. filed Aug. 3, 1899. The electrodes consist of perforated tubular bodies in which the active material is placed, the upper ends of said bodies being slitted to recive a connecting bar.

652,390. ELECTRIC GOVERNOR; W. W. Handy, Baltimore, Md. App. filed March 9, 1899. This is an electric device for governing the supply of water to water wheels, the invention consisting in details of construction.

652,419. ELECTRIC TRAMWAY; E. Bonnet, J. Caufique and G. Lienaire, of

Lyons, France. App. filed March 27, 1900. This invention is intended to prevent the short circuit which sometimes occurs at crossings in that character of railway in which the feeding contacts are placed in the surface of the roadbed, and the invention consists in interposing the resistances between the supply conductor and the contact located near the crossing whereby only a small current can pass to both contacts.

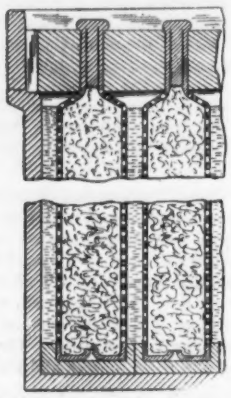
652,430. ELECTRIC HAND LIGHTING GAS BURNER; G. J. Galbraith, Boston, Mass. App. filed Aug. 24, 1899. Details.

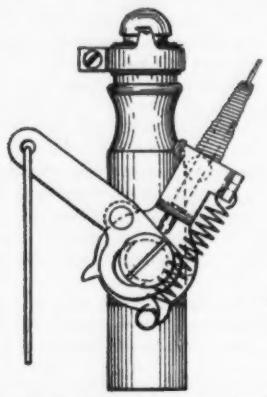
652,432. TELEPHONE SYSTEM; C. C. Gould, Philadelphia, Pa. App. filed Feb. 12, 1900. The secondary of an induction coil is wound around a resistance and is in series with the main circuit, while the primary of the coil is in series with a local battery circuit, and in this local battery circuit, the transmitter and receiver are connected in multiple. This is for the purpose of increasing the sound and in making it more clear.

652,436-7. THERMOELECTRIC BATTERY OR PILE; J. Matthias, of Stuttgart, Germany. App. filed June 19, 1900. (See Current News and Notes.)

652,438. ELECTRIC RAILWAY SYSTEM; L. M. Maxhan, Boston, Mass. App. filed Sept. 20, 1899. In this system the circuit is closed by a magnet on the car lifting a movable plug into contact with a sectional conductor. The tail of the plug is immersed in mercury, to which the supply main is connected.

652,446. ELECTRO-MEDICAL BATH; J. J. Stanger, Ulm, Germany. App. filed April 20, 1900. A bath tub is equipped with divided electrodes which





652,385.—Secondary Battery. 652,430.—Electric Hand Lighting Gas Burner.

are arranged around its edges, any number of which may be thrown into the liquid for the purpose of obtaining any desired distribution of the current through the liquid.

652,453-4. ALTERNATING CURRENT ELECTRIC METER; Emile Batault, of Geneva, Switzerland. App. filed Aug. 2, 1898. Two shunt coils diametrically disposed to the armature induce fields of opposite polarity in the latter whereby a checking effect is produced on the rotating armature. Series enclosed coils are provided for inducing fields of different phase in the armature, there being two of the former and a closed conductor located between the series coils and the armature. The second patent relates to details of the same meter; the operating magnets each have a shunt and one or more series coils, the latter being arranged within but eccentrically to the field of influence of the shunt coils. The magnets are of a construction to permit the lines of force to pass directly through the armature. One or both of the magnets is arranged to be adjusted out of the line of the centre of rotation of the armature.

652,485. COMBINED GEAR MUFFLER AND SHUNT FOR MAGNETO-GENERATORS; J. G. Nolen, Chicago, Ill. App. filed May 10, 1900. A spring is arranged to act upon the pinion on the armature shaft in such a way as to absorb the back lash and thus prevent noise.

652,494. ELECTRIC LIGHTING APPARATUS; Charles A. Terry, New York. App. filed July 14, 1898. (See Current News and Notes, page 22, et seq.)

652,494. ELECTRIC LIGHTING APPARATUS; Charles A. Terry, of New York, N. Y. App. filed July 14, 1898. (See Current News and Notes.)

652,504. ELECTRIC HEATER; Edward Bennett, of Jeannette, Pa. App. filed Dec. 7, 1899. (See Current News and Notes.)

652,508. MICROPHONE TRANSMITTER; Clayton B. Clark and Charles E. Clark, of Sing Sing, N. Y. App. filed July 25, 1899. Two diaphragms are employed, the outer one being provided with perforations; the inner diaphragm, which is less in diameter than the outer one, is unconfined at its rim and rests on a bed of carbon and felt, and separated from the outer diaphragm by a bed of carbon retained by an elastic rim located within the circle of perforations of the outer diaphragm. The outer diaphragm imparts its motion to the air behind it and this air in turn acts upon the inner one; in addition some of the direct vibrations act through the perforations directly upon the inner diaphragm.

652,564. SUBTERRANEAN CURRENT DISTRIBUTION FOR ELECTRIC STREET CARS; Eduard von Mairhofen, of Wurzburg, Germany. App. filed March 9, 1900. Sections of a conduit line are mechanically thrown into and out of circuit, these switching operations being effected by the car, which imparts in passing a partial revolution to a rail about its longitudinal axis by means of a finger piece, such fractional revolution being transmitted to a lever which closes the corresponding portion of the conductor.

652,596. SWITCH FOR ELECTRIC CIRCUITS; Ethan I. Dodds, of Avalon, Pa. App. filed Sept. 9, 1899. (See Current News and Notes.)

652,597. SWITCH FOR LAMP CIRCUITS; Ethan I. Dodds, of Avalon, Pa. App. filed Sept. 9, 1899. (See Current News and Notes.)

652,598. SNAP SWITCH FOR ELECTRIC LAMP CIRCUITS; Ethan I. Dodds, of Avalon, Pa. App. filed Sept. 9, 1899. (See Current News and Notes.)

652,599. AUTOMATIC PUSH BUTTON SWITCH FOR ELECTRIC LAMPS; Ethan I. Dodds, of Avalon, Pa. App. filed Sept. 9, 1899. (See Current News and Notes.)

652,600.—KNIFE SWITCH FOR ELECTRIC LAMP CIRCUITS; Ethan I. Dodds, Avalon, Pa. App. filed Sept. 9, 1899. (See Current News and Notes.)

652,601. CUT-OUT FOR ELECTRIC LAMP CIRCUIT; Ethan I. Dodds, Avalon, Pa. App. filed Sept. 9, 1899. (See Current News and Notes.)

652,607 and 652,610. ELECTRIC LIGHTING APPARATUS; Marshall W. Hanks, of Pittsburg, Pa. Apps. filed March 24, 1899, and May 2, 1899. (See Current News and Notes.)

652,608. MULTIPLE GLOWER LAMP; Marshall W. Hanks, of Pittsburg, Pa. App. filed April 21, 1899. (See Current News and Notes.)

652,609. GLOWER TERMINAL FOR ELECTRIC INCANDESCENT LAMPS; Marshall W. Hanks, of Pittsburg, Pa. App. filed April 22, 1899. (See Current News and Notes.)

652,611. COMBINED DIAPHRAGM AND ELECTRODE; James Hargreaves, of Farnworth-in-Widnes, England. App. filed Feb. 12, 1898. A wire cloth or perforated plate is covered with a thin layer of clay adapted temporarily to form a retentive function and ultimately to be dissolved or washed away. A coating of Portland cement or equivalent hard or dense material is applied to the clay and the layer then covered with asbestos cloth, thus giving a stratified diaphragm, dense as to the one side and porous as to the other.

652,626. HEATER CUT-OUT DEVICE FOR ELECTRIC LAMPS; Walther Nernst and H. N. Potter, of Gottingen, Germany. App. filed Sept. 12, 1899. (See Current News and Notes.)

652,635. ELECTRIC HEATER AND SUPPORTING MATERIAL THEREFOR; H. N. Potter, of Gottingen, Germany. App. filed Aug. 9, 1899. (See Current News and Notes.)

652,636. CONTROLLING SYSTEM FOR ELECTRIC LAMP HEATERS; H. N. Potter, of Gottingen, Germany. App. filed Aug. 14, 1899. (See Current News and Notes.)

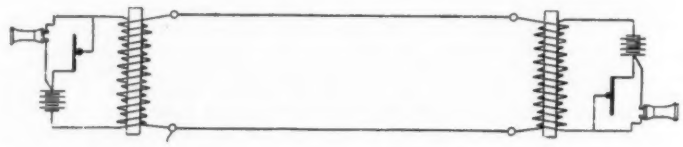
652,638. HEATER FOR ELECTRIC GLOWER LAMPS; H. N. Potter, of Gottingen, Germany. App. filed Sept. 8, 1899. (See Current News and Notes.)

652,639. HEATER CUT-OUT DEVICE FOR ELECTRIC LAMPS; H. N. Potter, of Gottingen, Germany. App. filed Sept. 11, 1899. (See Current News and Notes.)

652,640. ELECTRIC FURNACE; H. N. Potter, of Gottingen, Germany. App. filed Sept. 15, 1899. (See Current News and Notes.)

652,671. INSULATED ELECTRIC CONDUCTOR OR CABLE; Henry Edmunds, of London, England. App. filed May 1, 1900. An electrical conductor is surrounded with paper saturated with a mixture of resinous matter and oils of a waterproof character, which alternates with another paper winding saturated with an oily matter or treated with a lubricant.

652,676. AERIAL SWITCH FOR ELECTRIC RAILWAY; Otto Joedicke, of Muhlhausen, Germany. App. filed Dec. 11, 1899. This is an aerial switch



652,432.—Telephone System.

for the purpose of guiding trolleys from one trolley wire to another in either direction with safety. It consists of pivoted switch tongues in combination with tracks, the switch tongues being movable laterally at both ends; plates provided with longitudinal slots guide the trolley wheel.

652,699. MULTIPLE GLOWER LAMP; A. J. Wurts, of Pittsburg, Pa. App. filed April 21, 1899. (See Current News and Notes.)

652,700. IGNITING SYSTEM FOR ELECTRIC LAMPS; A. J. Wurts, of Pittsburg, Pa. App. filed June 9, 1899. (See Current News and Notes.)

652,701. IGNITING OR LIGHTING SYSTEM FOR ELECTRIC LAMPS; A. J. Wurts, of Pittsburg, Pa. App. filed June 9, 1899. (See Current News and Notes.)

652,702. CIRCUIT BREAKER FOR GLOWER LAMPS; A. J. Wurts, of Pittsburg, Pa. App. filed June 9, 1899. (See Current News and Notes.)

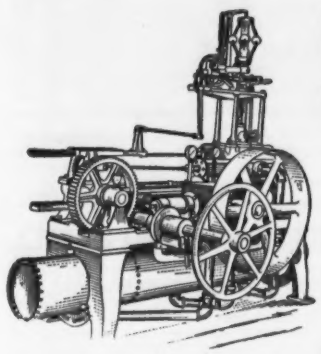
652,703. REMOVABLE PART FOR GLOWER LAMPS; A. J. Wurts and Marshall W. Hanks, of Pittsburg, Pa. App. filed July 24, 1899. (See Current News and Notes.)

652,704. ELECTRIC LAMP AND FIXTURE; A. J. Wurts, of Pittsburg, Pa. App. filed Aug. 19, 1899. (See Current News and Notes.)

652,705. HEATER TUBE SUPPORT FOR ELECTRIC LAMPS; A. J. Wurts, Marshall W. Hanks and Frederick M. Goddard, of Pittsburg, Pa., and Edward Bennett, of Jeannette, Pa. App. filed Dec. 7, 1899. (See Current News and Notes.)

652,706. MEANS FOR HEATING HIGH VOLTAGE GLOWERS; A. J. Wurts, of Pittsburg, Pa. App. filed Dec. 7, 1899. (See Current News and Notes.)

652,734. ALARM SYSTEM; Clyde Coleman, of Chicago, Ill. App. filed Oct. 18, 1897. Relates to an alarm system operating through the agency of an alternating current in such a manner that any attempt to tamper with or defeat the system will sound an alarm. The variable element connected with the device may be a reactance coil, and means are provided whereby the reactance of this coil may be varied from time to time. The signaling device is irresponsive to prearranged variations, but responds to abnormal variations.



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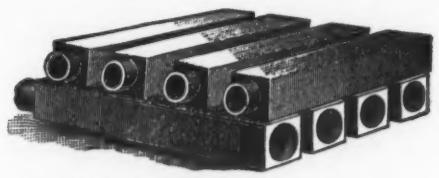

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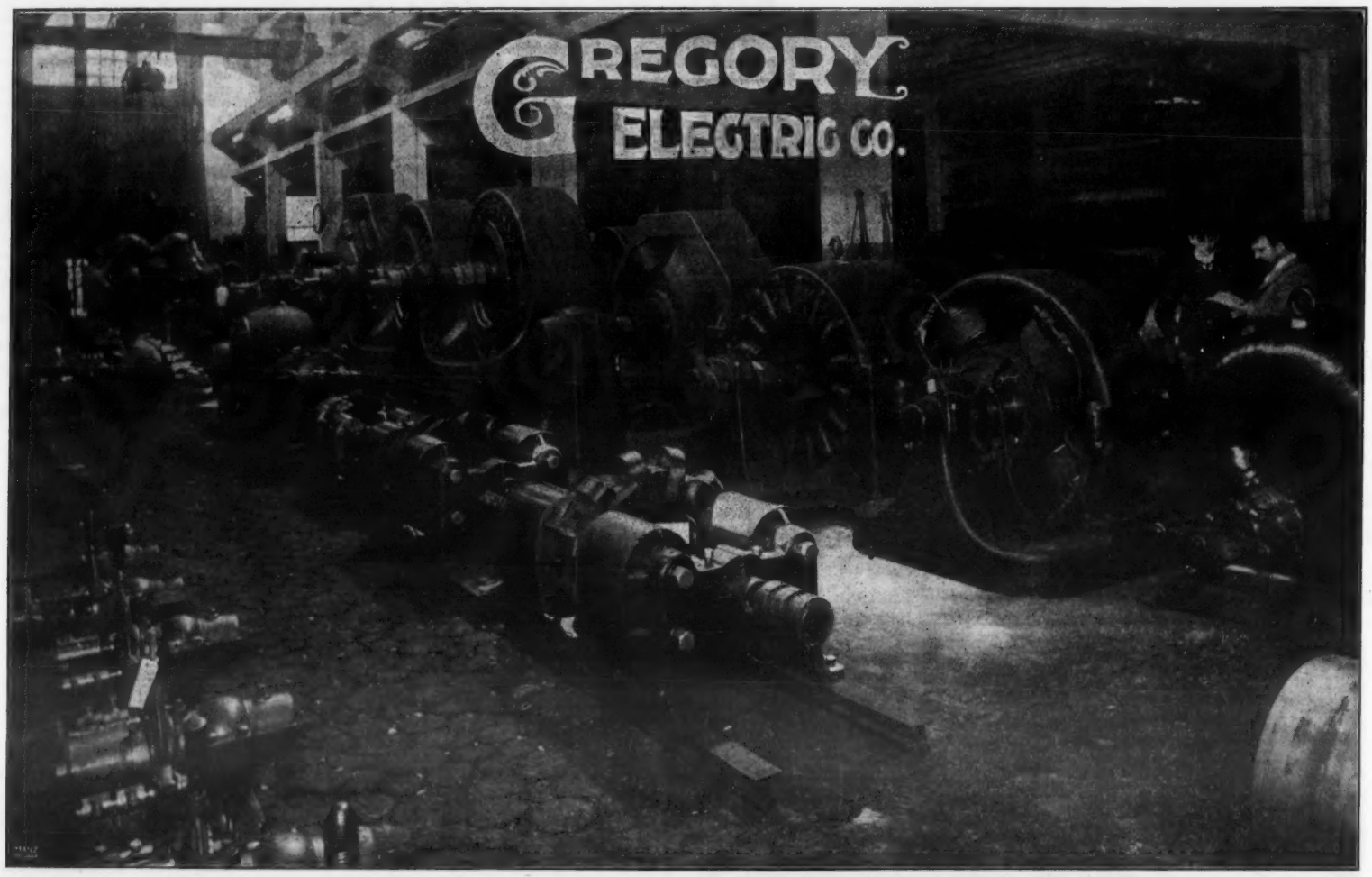

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DIRECT CURRENT.

500 VOLTS.

2 60-kw Edisons.
1 50-hp C & C, 700 r. p. m.
1 30-hp, moderate speed, M. P., Westinghouse.
1 25-hp T.-H.
1 25-hp Keystone.
1 25-hp M. P. Eddy.
1 20-hp M. P. Westinghouse.
1 15-hp M. P. Eddy.
1 15-hp M. P. General Electric.
1 10-hp Eddy.
1 3-hp Sprague.

RAILWAY GENERATORS.

2 850-kw General Electric, 80 r. p. m., direct connected to Allis cross compound engines.
2 425-kw General Electric, 100 r. p. m., direct connected to Allis cross compound engines.
1 800-kw Walker, for direct connection.
2 500-kw General Electric M. P., belt driven.
2 500-kw Westinghouse, M. P., belt driven.
2 375-kw Westinghouse M. P., belt driven.
2 200-kw General Electric M. P., belt driven.

ARC DYNAMOS.

2 165-light, multi-circuit Brush, 1200 cp, $2000 each.
2 No. 11, 125-light, multi-circuit, 2000 cp, $1950 each.
2 125-light, single-circuit, 200 cp. Brush, $1700 each.
2 125-light, latest type Fort Wayne, 2000 cp, $1500 each.
2 125-light, brand new Excelsior, 2000 cp, $1500 each.
4 No. 8, 65-light, 2000 cp, Brush, $575 each.

ENGINES.

19 x 35 x 48 Tandem Greene for direct connection.
26 in. x 60 in. Harris Corliss.
26 in. x 48 in. Allis Corliss.
18 in. x 42 in. Knowlson & Kelly Corliss.
15½ in. x 16 in. New York Safety
11 in. x 19 in. x 24 in. Tandem Buckeye.
Power.
2—600 H.P. Snow Condensers.
1—600 H.P. Nordberg Condenser.
Water-tube and return tubular boilers.

SEND FOR OUR LATEST CATALOGUE.

ROSSITER, MacGOVERN & CO.,

PRINCIPAL OFFICES,
141 BROADWAY, NEW YORK.
FACTORY, BROOKLYN, N.Y.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.

BARGAINS FOR SALE.

ALTERNATING GENERATORS.

1 350-light Thomson-Houston, A18.
1 600 " Bain, 30 K.W., self-oiler, new toothed armature.
1 600 " T.-H., A6, 30 K.W.
1 600 " T.-H., 30 K.W., two-phase, 1100 volts.
1 650 " T.-H., A35, s. o.
2 750 " Westinghouse, 37½ K.W.
1 900 " 60-cycle Westinghouse, 45 K. W., s. o., with newly wound toothed armature.
1 1000 " Wood, 50 K.W., s. o., toothed armature.
1 900 " Warren, inductor type.
2 1200 " Westinghouse, 60 K.W., self-oiler, toothed armature.
1 1400 " Westinghouse, 70 K.W.
2 6000 " Westinghouse, 300 K.W., toothed armature, composite wound, self-oilers, out board bearings.
1 6000 " Westinghouse, 300 K.W., 2200 volts, toothed armature, composite wound, self-oiler, out board bearings.

ARC DYNAMOS.

1 20-light C.P. Western Electric.
1 25 " 2000 " T.-H.
1 30 " 2000 " Western Elec., s. s.
1 30 " 2000 " Brush, No. 7.
2 35 " 2000 " T.-H., LD2.
1 40 " 2000 " Wood, No. 7.
2 40 " 2000 " Western Elec., s. o.
1 45 " 2000 " T.-H., M12, ring art.
4 45 " 1200 " Brush, No. 7.
1 50 " 2000 " Excelsior, latest type.
2 50 " 1200 " T.-H., LD12.
1 50 " 2000 " Western Elec., s. o.
1 50 " 2000 " Brush, No. 7½.
2 60 " 2000 " Western Elec., s. o.
1 60 " 2000 " Westinghouse, tooth. arm't, 6-pole, D. C., s. o., complete with exciter.
3 60-light 2000 C.P. Wood, No. 8.
3 65 " 2000 " Brush, No. 8, new armature.
2 75 " 1200 " Standard.
1 75 " 2000 " Westinghouse, s. o., toothed arm't, D. C., 6-pole, complete with exciter.
3 125 " 1200 " Excelsior, latest type, self-oilers.

110-VOLT INCANDESCENT DYNAMOS.

2 12-light Edison, ¾ M.P.
1 25 " C & C, self-oiler.
1 35 " Westinghouse, self-oiler.
1 36 " Bernard, self-oiler.
1 50 " Hawkeye, self-oiler.
1 50 " Bain, self-oiler.
1 50 " Card, self-oiler.
2 90 " Westinghouse.
1 160 " Rockford.
1 180 " Westinghouse.
1 250 " Commercial comp., self-oiler.
1 260 " National comp., self-oiler.
1 270 " T.-H. comp., self-oiler.
1 300 " Eickmeyer.
1 340 " Eddy, self-oiler, compound.
2 350 " Hawkeye, comp. wound.
1 350 " National, self-oiler, comp.
3 350 " Edison, 20 K.W., self-oiler.
1 360 " Rockford, self-oiler, comp.
1 450 " Edison, 25 K.W., self-oiler.
1 400 " Wood, M.P., self-oiler.
1 450 " Rockford, self-oiler.
1 540 " Edison, 30 K.W., oil cup.
4 540 " Edison, 30 K.W., s. o., comp.
1 540 " Westinghouse, 3-pole, s. s., 30 K.W., self-oiler, new.
1 600 " E. & C., slow speed, M.P., self oiler, compound.
1 600 " Eickmeyer.
2 700 " Siemens & Halske, 40 K.W., M.P., slow speed.
2 700 " Westinghouse, 10-pole, s. s., 40 K.W., self-oiler, new.
1 800-light Rockford, s. o., new arm't.
4 800 " Edison, 45 K.W., self-oilers.
1 1350 " Waddell-Enz, 80 K.W., M.P., for direct connection.

500-VOLT GENERATORS.

1 25 K.W. T.-H., self-oiler, D25, comp.
1 25 " Edison, self-oiler.
1 30 " Jenney, self-oiler.
1 35 " Jenney, self-oiler.
1 35 " Mather, self-oiler.
1 45 " Edison, comp., self-oiler.
1 150 " Detroit, M.P., comp. s. o.

DIRECT CONNECTED RAILWAY GENERATORS.

1 100 H.P., 500-volt Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine 14x24x14, all complete, fine.

110-VOLT MOTORS.

1 1 H.P. Edison.
1 1½ " C & C, self-oiler.
1 2 " Westinghouse, self-oiler.
1 3 " Westinghouse.
1 3 " Bain, self-oiler.
2 7½ " Westinghouse.
1 12 " Rockford.
1 18 " National, self-oiler.
1 18 " Commercial, self-oiler.
1 18 " T.-H., self-oiler.
1 20 " Eickmeyer.
1 24 " Eddy, self-oiler.
2 25 " Hawkeye motors.
1 25 " Rockford.
2 30 H.P. Edison, 25 K.W., self-oilers.
1 25 " National, self-oiler.
4 25 " Edison, 20 K.W., self-oilers.
1 30 " Rockford.
1 30 " Wood, M.P., self-oiler.
1 35 " Edison, 30 K.W., oil cups.
7 35 " Edison, self-oilers.
1 35 " Westinghouse, 8-pole, s. s., 30 K.W., self-oiler, new.
1 40 " E. & C., M.P., slow speed.
1 40 " Eickmeyer.
1 50 " Siemens & Halske, M.P., s. o., slow speed.
2 50 " Westinghouse, 10-pole, s. s., 50 K.W., self-oilers, new.
1 60 " Rockford, self-oiler.
4 60 " Edison, 45 K.W., self-oilers.

220-VOLT MOTORS.

2 1 H.P. E. & C., new, s. o., M.P., s. s.
1 1 " Commercial, self-oiler.
1 3 " Crocker-Wheeler, s. o., s. s.
2 3 " Card, slow speed, self-oiler.
1 5 " T.-H., self-oiler.
1 5 " Westinghouse, self-oiler.
1 7½ " Roth, self-oiler.
2 7½ " Eddy, self-oilers.
1 7½ " Edison, self-oiler.
1 12 " T.-H., self-oiler.
1 16 " Crocker-Wheeler, elevator motor, with controller.
1 50 " Northern, M.P., s. o.
1 60 " Edison, self-oiler, 45 K.W.

500-VOLT MOTORS.

2 1 H.P. Jenney, self-oilers.
3 1 " Crocker-Wheeler, s. o., s. s.
1 1 " Lundell, self-oiler, slow speed.
1 2½ " Wood, self-oiler.
1 3 " Toledo, self-oiler.
1 3 " Jenney, self-oiler.
1 3 " Thomson-Houston.
2 3½ " Rockford, iron clad, s. o.
1 7½ " Jones, self-oiler.
1 10 " Eddy, self-oiler, M.P.
1 10 " C & C, self-oiler.
1 10 " Card, M.P., s. o., s. s.
1 18 " Thomson-Houston.
2 18 " C & C, self-oilers.
1 20 " Commercial, self-oiler.
1 20 " Card, self-oiler.
1 30 " T.-H., self-oiler.
1 30 " Edison, 25 K.W., self-oiler.
1 35 " Jenney, self-oiler.
1 40 " Jenney, self-oiler.
1 40 " Mather, self-oiler.
1 60 " Edison, 45 K.W., self-oiler.

Large stock of Meters, Arc Lamps, Station Instruments and Supplies. All apparatus fully guaranteed in perfect operative condition. Send for Monthly Bargain Sheet with complete list and net prices.

DYNAMOS = MONEY SAVERS! = ENGINES

110-125 VOLT DYNAMOS.
1 20-Light Crocker-Wheeler.
1 30-Light Crocker-Wheeler.
1 60-Light G. E.
1 100-Light U. S. Horizontal.
1 120-Light U. S. Horizontal.
2 300-Light T.-H. E. I., 16 kw.
4 270-Light Edison, 15 kw.
2 400-Light Edison, 20 kw.
4 500-Light Edison, 25 kw.
2 600-Light Edison, 30 kw.
4 900-Light Edison, 45 kw.
2 1,200-Light Edison, 60 kw.
1 1,800-Light Edison, 100 kw.
1 1,300-Light Western Electric, 80 kw.
1 900-Light D 50 T.-H.
2 150-kw, 1-76A, 125 volt, 220 rev. direct connected Siemens-Halske, extra armature.
2 500-Light Mather.
1 400-Light D 25 T.-H.

220-VOLT DYNAMOS.
1 D 50-kw T.-H.
1 80-kw C & C.
1 80-kw Elwell-Parker.
1 60-kw Eddy-M.P.
1 45-kw Walker, D. C., to 12x12 Ball Engine.
1 40-kw M. P. Commercial, D. C. to 11x12 Chandler-Taylor Engine.
1 25-kw M. P. Commercial, D. C., 10x12 Chandler-Taylor Engine.
1 25-kw M. P. Eddy, D. C., to 10x12 Russell Automatic.

500-VOLT RAILWAY OR POWER GENERATORS.
2 45-kw Edison Bipolar.
2 60-kw Edison Bipolar.
4 100-kw Edison Bipolar.
4 D 62 T.-H.
2 100-kw M. P. Detroit.
2 120-kw M. P. Mather.
1 50-kw Triumph.
2 100-kw Short.
4 75-kw multipolar T.-H.
1 90-kw M. P. T.-H.
1 D 40 T.-H.
1 40-kw C & C.
1 60-kw Eddy, M. P.

125-VOLT MOTORS.
1 ¼-hp Sprague.
1 ⅓-hp Sprague.
1 1-hp C & C.
1 1-hp Lundell.
3 1-hp Crocker-Wheeler.
1 1½-hp Crocker-Wheeler.
1 2-hp Edison.
1 2-hp Sprague.
1 2-hp G. E.
2 3-hp Crocker-Wheeler.
2 3-hp C & C.
1 5-hp Crocker-Wheeler.
1 10-hp U. S.
1 15-hp T.-H.
2 20-hp Edison.
2 25-hp Edison.
2 30-hp Edison.

220-VOLT MOTORS.
1 1-hp C & C.
1 1-hp Crocker-Wheeler.
1 3-hp Crocker-Wheeler.
1 5-hp Edison Bipolar.
1 6-hp Storey.
1 10-hp C & C.
2 12-hp C & C.
1 15-hp D 15 T.-H.
1 50-hp G. E., M. P.
1 65-hp D 50 T.-H.
1 100-hp C & C.
1 100-hp Elwell-Parker.

500-VOLT MOTORS.
Complete, with base frame, pulleys and automatic release starting box.
1 1-hp C & C.
1 3-hp C & C.
1 1-hp Jenny.
1 3½-hp Eddy.
1 50-hp C & C.
2 40-hp G. E., M. P.

TWO-PHASE ALTERNATOR.
1 60-kw Stanley Inductor Alternator, 60 cycles, 1000-2000 volts, complete, with exciter and instruments.
1 75-kw Stanley 2-phase Alternator, complete, with exciter and instruments.

SINGLE-PHASE ALTERNATORS.
2 600-Light T.-H., 1,040 volts.
1 600-Light A 30 T.-H., 1,040 volts, ironclad.
6 650-Light A 35 T.-H., 1,040 volts.
1 750-Light 37½-kw Westinghouse, 1,040 volts.
2 750-Light 37½-kw Fort Wayne, 1,040 volts.
2 750-Light 37½-kw Fort Wayne, 1,040 volts.
4 750-Light, 37½-kw, Fort Wayne, 1,040 volts, ironclad.
2 1,200-Light 60-kw Slattery, S. O., surface-wound, 1,040 volts.
2 1,200-Light 60-kw T.-H. A 60, ironclad, 1,040 volts.
1 900-Light 45-kw West, ironclad, 1,040 volts.
1 1,000-Light 50-kw Fort Wayne, 1,040 volts.
1 1,200-Light A 60 T.-H., ironclad, 2,080 volts.
1 1,500-Light No. 2 West, ironclad, 1,040 volts.
2 1,200-Light Brush, 60-kw, 2,080 volts.
2 1,200-Light West, 60-kw, 1,040 volts, ironclad.
2 1,400-Light T.-H. A 70, S. O., surface wound, 1,040 volts.
1 2,000-Light 100-kw Fort Wayne, 2,080 volts.
1 2,400-Light A 120, T.-H., ironclad, 1,040 volts.
2 2,400-Light A 120, T.-H., ironclad, 2,080 volts.
4 3,000-Light 150-kw West., surface, 1,040 volts.
1 4,800-Light A 240-kw, ironclad, 1,040 volts.
1 6,000-Light A 300-kw, ironclad, 1,040 volts.

Our list of Alternators is constantly changing. Write or wire for anything not shown in he list.

ARC DYNAMOS.
Base frame, pulley, regulator and brushes with each machine.
1 18-Light, 1,200-cp, T.-H.
1 20-Light, 2,000-cp, Excelsior.
3 25-Light, 2,000-cp, Ft. H. W. Wood.
2 25-Light, 2,000-cp, T.-H., S. O. B., Ring Arm.
3 30-Light, 2,000-op, T.-H.
2 30-Light, 2,000-cp, Brush, new.
4 35-Light, 2,000-cp, T.-H., Ring Arm, S. O.
2 35-Light, 2,000-cp, T.-H., Ring Arm, O. C.
2 40-Light, 2,000-cp, Fort Wayne Wood.
1 L. D. 12 T.-H. Arc.
1 80-Light, 2,000-cp, Brush.
3 125-Light, 2,000-cp, "

TYPE E. T. H. TRANSFORMERS.
3 5-Light, 1,040x2,080x52x104 volts.
12 20-Light, 1,040x2,080x52x104 volts.
10 15-Light, 1,040x2,080x52x104 volts.
20 25-Light, 1,040x2,080x52x104 volts.

TYPE F. T. H. OIL TRANSFORMERS.
18 6-Light, 1,040x2,080x52x104 volts.
7 12-Light, 1,040x2,080x52x104 volts.
12 30-Light, 1,040x2,080x52x104 volts.
6 30-Light, 1,040x2,080x52x104 volts.
1 50-Light, 1,040x2,080x52x104 volts.
1 70-Light, 1,040x2,080x52x104 volts.
1 90-Light, 1,040x2,080x52x104 volts.
5 150-Light, 1,040x2,080x52x104 volts.

TRANSFORMERS.
Stanley.
1 5-Light, 1,000 to 50 volts.
62 10-Light, 1,000 to 50 volts.
9 10-Light, 1,000 to 100 volts.
72 10-Light, 2,000 to 50 volts.
1 10-Light, 2,000 to 100 volts.
15 15-Light, 1,000 to 50 volts.
4 20-Light, 1,000 to 50 volts.
1 20-Light, 1,000 to 50 or 100 volts.
2 20-Light, 1,000 to 2,000-50 or 100 volts.
12 30-Light, 1,000 to 50 volts.
5 30-Light, 1,000 to 50-100 volts.
1 30-Light, 2,000-50-100 volts.
6 30-Light, 1,000-2,000-50-100 volts.
39 40-Light, 1,000 to 50 volts.
1 40-Light, 1,000 to 2,000-50-100 volts.
2 50-Light, 1,000 to 50 volts.
1 50-Light, 2,000-50-100 volts.
2 75-Light, 1,000 to 50 volts.
1 75-Light, 1,000 to 50-100 volts.
5 75-Light, 1,000 to 2,000-50-100.
1 80-Light, 1,000 to 50 volts.
6 100-Light, 1,000 to 50.
15 100-Light, 1,000 to 50.
11 100-Light, 1,000-50-100.
1 150-Light, 1,000-100 volts.
1 175-Light, 1,000-100 volts.
2 200-Light, 1,000-50 volts.
1 250-Light, 1,000-50 volts.
1 250-Light, 1,000-50-100 volts.
1 250-Light, 2,000-50-100 volts.
2 350-Light, 1,000 to 50 volts.
1 350-Light, 1,000 to 50-100 volts.
1 400-Light, 1,000-2,000-50-100 volts.

THOMSON-HOUSTON.
Type F. Oil, T. H.
8 6-Light, 1,000-50-100 volts.
38 12-Light, 1,000-50-100 volts.
32 20-Light, 1,000-50-100 volts.
20 30-Light, 1,000-50-100 volts.
18 50-Light, 1,000-50-100 volts.
20 70-Light, 1,000-50-100 volts.
11 90-Light, 1,000-50-100 volts.
3 150-Light, 1,000-50-100 volts.
1 240-Light, 1,000 - 100 - 200 volts.
3 300-Light, 1,000 - 100 - 200 volts.
7 6-Light, 2,000-50-100 volts.
8 12-Light, 2,000-50-100 volts.
9 20-Light, 2,000-50-100 volts.
6 30-Light, 2,000-50-100 volts.
10 50-Light, 2,000-50-100 volts.
4 70-Light, 2,000-50-100 volts.
3 90-Light, 2,000-50-100 volts.
2 150-Light, 2,000-50-100 volts.

Separate fuse boxes will be furnished at $1.50 per transformer additional.

ALT. CURRENT MOTORS.
1 3½-hp Ft. Wayne, single phase, 60 cycles, 110 volts.
1 1-hp, Ft. Wayne, single phase, 60 cycles, 110 volts.
1 1½-hp Stanley, single phase, 125 cycles, 110 volts.
1 3-hp, Type C, Westinghouse, 2-phase, 200 volts, new.
1 7½-hp, Type C, Westinghouse, 60 cycles, 2-phase, 200 volts.
1 10-hp Excelsior, single phase, 100 volts.
1 30-hp 2-phase, West.
1 200-hp 2-phase, West.
1 5-hp, Ft. Wayne, single phase, 60 cycles.

METERS.
SHALLENBERGER METERS—WESTINGHOUSE.
60 OR 133 CYCLE.
57 20-amp.
50 50-amp.
2 80-amp.

WHITNEY ALT. CURRENT INSTRUMENTS.
BRASS CASE AMMETERS.
3 15-ampere.
4 25-ampere.
6 30-ampere.
2 40-ampere.
2 55-ampere.
1 60-ampere.
1 70-ampere.
9 75-ampere.
1 90-ampere.
3 100-ampere.
6 250-ampere.

BRASS CASE VOLT METERS, ALT.
3 60-volts.
9 120-volts.
2 600-volts.

IRON CASE AMMETERS, ALT.
2 5-ampere.
5 15-ampere.
1 20-ampere.
2 30-ampere.
2 40-ampere.
1 45-ampere.
1 50-ampere.
6 75-ampere.

ARC LAMPS FOR SERIES CIRCUIT.
2 120-volts.

These quotations contemplate the lamps being overhauled and repaired, and put in prime operative condition. We can quote a much lower figure on them in condition as they come from the line.
196 9.6-amp., T.-H., single K2.
160 6.9-amp., T.-H., single K12.
40 9.6-amp., T.-H., single K2, short.
27 9.6-amp., T.-H., double D.
466 6.8-amp., T.-H., double M. 12.
69 9.6-amp., T.-H., double M2.

THOMPSON SON & CO., 107 LIBERTY STREET, N.Y.

CHICAGO EDISON COMPANY
REPAIR SHOPS.
76 MARKET STREET, CHICAGO. TELEPHONE, MAIN 1280.
First-Class Equipment in all Shops.
OPEN DAY AND NIGHT. PROMPT ATTENTION.
Dynamos, Armatures, Motors, Arc Lamps, Instruments, Machine Shop; Engines, Etc., Carpenter Shops; Cabinets, Etc.
Correspondence Solicited.

FOR SALE.
INTERESTING PRICES AND QUICK DELIVERY.

ALTERNATORS.
1-120 K.W. West'ghouse.
2-120 " Gen. Elec.
1-100 " Gen. Elec.
1- 60 " Stanley.
1- 60 " Gen. Elec.
1- 50 " Ft. Wayne.
1- 50 " West'ghouse.
1- 45 " West'ghouse.
2- 37 " West'ghouse.
1- 35 " T.-H.
1- 30 " Gen. Elec.
1- 30 " West'ghouse.

ARC DYNAMOS.
2-160 Lt. Brush.
2- 80 " Brush.
4- 60 " Brush.
2- 50 " Wood.
1- 50 " T.-H.
1- 35 " T.-H.
1- 30 " T.-H.

ENGINES.
1-250 H.P. Wheelock.
1-200 " McI. & S.
1-175 " Ideal.
1-150 " Ball.
1-150 " Russell.
3-125 " Ball.
1-100 " Payne.
1-100 " Ball.
1- 80 " Ideal.
1- 75 " A. & S.
1- 65 " N. Y. Safety.
1- 60 " Ball.
1- 50 " West'ghouse.

Write us about Dynamos, Motors, Engines, Boilers, etc., to buy or sell.

MAYO & ROHRER CO.,
220 BROADWAY, NEW YORK.

HIGH GRADE REPAIRS
TO DYNAMOS, MOTORS, ARMATURES, FIELDS LAMPS AND TRANSFORMERS. RECONSTRUCTING A SPECIALTY.
TELEPHONE 1690 MAIN.
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WANTED FOR SPOT CASH
BURNED OUT INCANDESCENT LAMPS AND BASES
Freight Paid and Highest Prices Guaranteed.
GEO. F. SCHWALM CO., - HARRISON, N. J.

FOR SALE.

MOTORS.
1 H.P. 110 Eddy.
2 " 110 Eddy.
3-12 " 110 Elec.-Dynamic.
1 " 220 C & C.
2 " 220 Sprague.
2 " 220 Excelsior.
3 " 220 Mayer.
3 " 220 Sprague.
10 " 220 T.-H.
20 " 220 C & C.
10 " 550 C & C.

DYNAMOS.
15-light Cleveland.
30 " West.
75 " Mayer.
100 " Western Elec.
2-160 " Elec.-Dynamic.
300 " U. S.
450 " Onondaga.
15 K.W. Detroit.
20 " T.-H.
2- 45 " West, M.P., almost new.
2- 85 " Wenstrom.
1-100 " West, 6-pole.

ENGINES.
30 H.P. Paine.
45 " M. & S.
60 " Ames.

Large stock of ELECTRIC FANS, all voltages, new and second-hand; also TRANSFORMERS.

H. J. LINDER & CO.,
123 LIBERTY STREET, NEW YORK.

GUARANTEE ELECTRIC CO.,
133-139 So. CLINTON ST., CHICAGO, ILL.
MANUFACTURERS
Standard Arc Lamps for all Circuits.
New and Second-Hand Machinery and Supplies. Armature Winding and Repair Work.

WANTED--FOR CASH.

500,000 lbs. of Bare Copper Trolley Wire.

250,000 lbs. of Ordinary Bare Copper Wire (Scrap).

250,000 lbs. of Insulated Copper Wire.

125,000 lbs. of Heavy Red Brass (Scrap).

125,000 lbs. of Heavy Yellow Brass (Scrap).

125,000 lbs. of Light Sheet Brass.

5,000 lbs. of Platinum, at $14.00 per troy oz.

Any of the above bought in large or small quantities.

We supply the electrical trade with our high grade Babbitt Metal, Solder and Cotton Waste. Give us a trial order and you will find we will save you money.

CHICAGO'S LEADING METAL HOUSE. ESTABLISHED 1885.

SWARTS METAL REFINING COMPANY,

REFERENCES: { Bank of Commerce, Dun's Agency, Bradstreet's Agency.

OFFICE AND WORKS. 20 & 22 N. Des Plaines St., CHICAGO. ILLS.

SECOND-HAND Dynamos and Motors.

WE INVITE CORRESPONDENCE WITH THOSE WISHING TO BUY OR SELL.

SCHUREMAN & HAYDEN,

137 S. Clinton St., Chicago.

FOR SALE.

One 13-Horse-Power Hornsby-Akroyd Oil Engine,

AS GOOD AS NEW.

Costs Less than One Cent per Hour to Operate. Suitable for Small Shop.

COLUMBIA ELECTRICAL SUPPLY CO., 93 Liberty Street, New York.

FOR IMMEDIATE DELIVERY.

110 VOLT GENERATORS.

1—2500-light, 150 K.W. General Electric, 6-pole, 550 r. p. m.
2—1600 " 100 K.W. Edison, bipolar.
1—1200 " 65 K.W. General Electric, 4-pole, 825 r. p. m.
6— 810 " 45 K.W. Edison, bipolar.
2— 540 " 30 K.W. Edison, bipolar.
1— 270 " 15 K.W. Edison, bipolar.
1— 30 K.W. Edison, bipolar, 220 volts.
1— 30 " Jenny, 725 r. p. m., 220 v.

500 VOLT RAILWAY GENERATORS.

1—New 120 K.W. Mather, 4-pole.
1—New 80 " Eddy, Type G, 4-pole, 700 r. p. m.

ALTERNATING GENERATORS.

2—120 K.W. Westinghouse, single-phase, 1100 volts, 16,000 alternations, comp. wound, iron clad, self-oiling, complete with Exciters.
1— 37½ " Slattery, single-phase, 1100 volts, with Exciter.
2— 30 " Westinghouse, single-phase, 1100 volts, with Exciters and instruments.
1—New 360 K.W. Stanley, two-phase, 2400 or 2200 volts, 16,000 alt., 460 r. p. m.
1—New 150 K.W. Stanley, two-phase, 2200 or 1100 volts, 16,000 alt., 800 r. p. m.
1—New 50 K.W. Stanley, two-phase, 2400 or 2200 volts, 16,000 alt., 1333 r. p. m.
1—New 40 K.W. Stanley, two-phase, 2400 or 2200 volts, 16,000 alt., 1333 r. p. m.

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4—100 K.W. Westinghouse, single-phase, 1100 volts, 137 cycles, 12-pole, 1375 r. p. m.
1—120 " Slattery, single-phase, 1100 volts, 140 cycles, 16-pole, 1050 r. p. m.
1— 90 " Standard single-phase, 2000 volts, 133 cycles, 16-pole, 1000 r. p. m.

1—200 K.W. Fort Wayne, single-phase, 1100 volts, 700 r. p. m., 125 cycles, 24-pole.
1—240 " Stanley, two-phase, 1100 v., 400 r. p. m., 125 cycles, 40-pole.
1— 50 " National, single-phase, 2000 volts, 125 cycles.
1—100 " T.-H., single-phase, 1100 v., 125 cycles, 1000 r. p. m.

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2—35 " T.-H., 2000 C.P.
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1—300 " Campbell Zell, 160 lbs.; with Murphy stokers.
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4—125 " 66 in. x 16 ft., 100 lbs., with Murphy stokers.
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2—100 " 66 in. x 16 ft., 90 lbs.
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1—18½ x 18 Ideal.
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1—14½ x 15 McIntosh & Seymour.

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2—Vindex, capacity 20 lights.
1—Diamond, capacity 20 lights.
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1—New Stanley, capacity 30 lights, primary 2000 or 1000, secondary 100 or 50.
1—New Stanley, capacity 40 lights, primary 2000 or 1000, secondary 100 or 50.
3—New Stanley, capacity 50 lights, primary 2000 or 1000, secondary 100 or 50.
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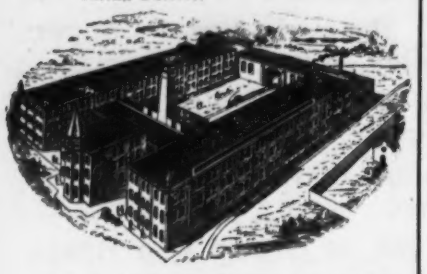

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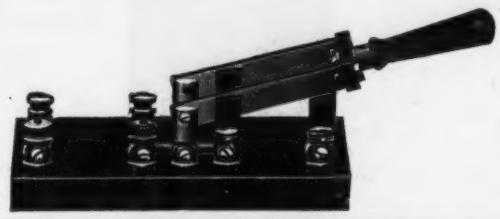

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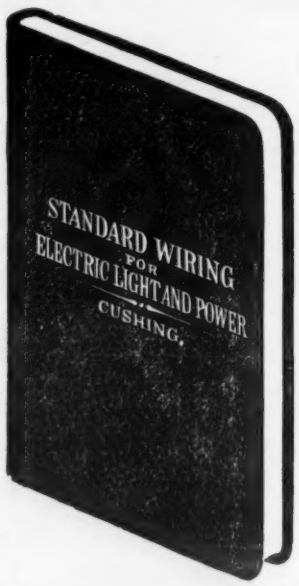

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The specifications, together with the map and drawings, may be seen on application to E. P. Howarth, Village Clerk, Grinnell Library Building, Wappingers Falls, N. Y.

The award of the contract, if awarded, will be made within one week after the opening of the proposals. No bid or proposal will be received or considered unless accompanied by either money or certified check upon one of the State or National Banks in the State of New York, drawn to the order of the Treasurer of the Village of Wappingers Falls to the amount of Five Hundred dollars ($500). The money or checks must not be enclosed with the bid, but will be examined before the bids are opened. The Village Board reserves the right to reject any and all bids.

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One 200-light Quaker City Dynamo (bipolar), compound, 110 volts.
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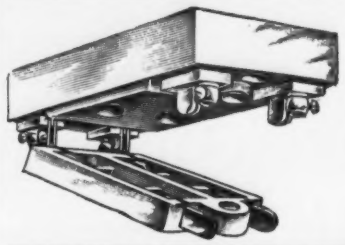

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